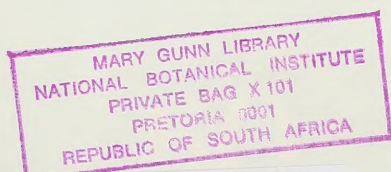
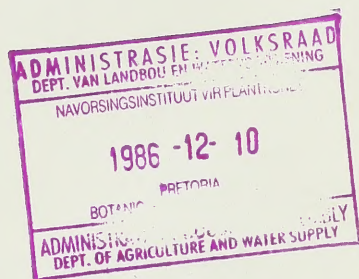


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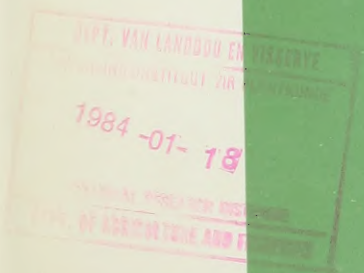
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THE TAXONOMY OF THE *PELARGONIUM PELTATUM* (L.) L'HÉRIT. COMPLEX

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ABSTRACT

The taxonomy of *Pelargonium peltatum* and all the other taxa which have been included in the section *Dibrachya* of the genus *Pelargonium* at some time or other, has been revised. It is concluded that only one species is involved, viz. *Pelargonium peltatum*.

UITTREKSEL

DIE TAKSONOMIE VAN DIE *PELARGONIUM PELTATUM* (L.) L'HÉRIT. KOMPLEKS

Die taksonomie van *Pelargonium peltatum* en al die ander taksons wat op een of ander tydstop ingesluit was in die seksie *Dibrachya* van die genus *Pelargonium*, is hersien. Daar is tot die slotsom gekom dat slegs een spesie ter sprake is, nl. *Pelargonium peltatum*.

Key words: *Pelargonium peltatum* complex, taxonomy.

INTRODUCTION

Geranium peltatum was one of twenty species of *Geranium* described by Linnaeus in his *Species Plantarum* (1753). The name was based on plants grown in Clifford's garden. In 1789 L'Héritier transferred this species to his new genus *Pelargonium*. In the same publication, Aiton's *Hortus Kewensis* ed. 1, L'Héritier described *P. lateripes*, which was illustrated in his *Geranologia*, t. 24 (1792).

Salisbury published a new name, *P. hederæfolium*, for *P. lateripes* in 1796. The year 1805 saw the publication of the first volume of Andrews' *Geraniums* in which he described the var. *variegatum* of *P. peltatum*, and *Geranium hederinum* with the varieties *flore albo* and *variegatum*. In the sec-

ond volume, published in 1806, he described *Pelargonium peltatum* var. *superbum* and *Geranium hederinum* var. *zonales*; all of garden origin.

The first volume of Sweet's *Geraniaceae*, published in 1821, contains the description of *Pelargonium scutatum* and *P. pinquifolium*. Sweet expressed some doubt as to whether *P. pinquifolium* may possibly have been of hybrid origin. In 1824 De Candolle published the first volume of his *Prodromus*, with descriptions of *P. lateripes* var. *albomarginatum* and var. *walneri*, as well as *P. peltatum* var. *zonatum*. Also in 1824, Hoffmannsegg published in his *Verzeichniss der Pflanzenkultur*, the name *P. glabrum*.

In 1826 Sweet published his *Hortus Britannicus*, which included descriptions of three varieties of *P. lateripes* cultivated in British gardens, viz. vars. *roseum*, *viridifolium* and *zonation*. Ecklon & Zeyher, in *Enumeratio Plantarum* vol. 1 (1835), used a new generic name, *Dibrachya*. This genus was based on Sweet's (1805) section *Dibrachya*, which was published with a short description but no reference to any species. Ecklon & Zeyher included three species in this genus, viz. *Dibrachya peltata* (based on *Geranium peltatum* L.), *D. scutata* (based on *P. scutatum* Sweet), and *D. clypeata*, based on their own collection. In 1841 Steudel transferred *D. clypeata* to the genus *Pelargonium* in his *Nomenclator Botanicus*.

The first comprehensive account of the natural South African species of *Pelargonium*, by Harvey in volume 1 of Harvey & Sonder's *Flora Capensis*, appeared in 1860. This work contains descriptions of one new variety (*P. peltatum* var. *glabrum*), and two new combinations, *P. peltatum* var. *scutatum* (based on *P. scutatum* Sweet) and *P. peltatum* var. *clypeatum* (based on *Dibrachya clypeata* Eckl. & Zeyh.).

In 1880 Saint-Lager published a new name for *P. lateripes*, namely *P. lateripedatum*. In 1890 Robert Brown described *P. saxifragoides* from a live plant grown in the Kew Gardens. Kuntze transferred *Geranium peltatum* L. to his new genus, *Geraniospermum*, in 1891.

The second comprehensive treatment of the natural species of *Pelargonium*, and the last to date, was Knuth's treatment in *Das Pflanzenreich*, which appeared in 1912. He described yet another species, *P. bachmannii*, from material collected by Bachmann in Pondoland.

The aim of this present investigation was to subject this long list of taxa to a critical taxonomic examination to determine their individual or collective status.

***Pelargonium peltatum* (L.) L'Hérit.** in Ait., Hort. Kew. ed. 1, 2: 427 (1789); Salisb., Prodr.: 315 (1796); Willd., Sp. Pl. 3, 1: 669 (1800); Dietrich,

FIG. 1.

Lectotype specimen of *Pelargonium peltatum* in Hort. Cliff. 345.14 (BM).
(Photo J. J. A. van der Walt).



Lex. Gärt. Bot. 7: 47 (1807); Pers., Syn. Pl. 2: 231 (1807); Haw., Syn. Pl. Succ.: 307 (1812); DC., Prodr. 1: 666 (1824); G. Don, Gen. Syst. 1: 738 (1831); Steud., Nom. Bot. ed. 2, 2: 288 (1841); Harv. in Fl. Cap. 1: 293 (1860); Knuth in Pflanzenr. 4, 129: 422 (1912); Marloth, Fl. S. Afr. 2: 87, t. 31 (1925); Batten & Bokelmann, Wild. Flow. E. Cape Prov.: 87, t. 73, fig. 5 (1966); Gledhill, E. Cape Veld Flow.: 141, t. 33, fig. 5 (1971); Clifford, Pelargoniums, ed. 2: 225 (1970); J. J. A. v.d. Walt, Pelarg. S. Afr. 1: 33, t. 33 (1977). Type: sine loc. et. leg. in Herb. Hortus Siccus Cliffortianus (BM, lecto.!) (Fig. 1).

Geranium peltatum L., Sp. Pl. ed. 1, 2: 678 (1753); ed. 2, 2: 947 (1763); Burm. f., Geran.: 38 (1759); L., Syst. Veg. ed. 14: 613 (1784); Cav., Diss. 4: 232, t. 100, fig. 1 (1787); Curtis in Curtis's bot. Mag. 1: t. 20 (1787); Thunb., Prodr. 1: 113 (1794); Andr., Geran. 1: t. 44 (1805); Thunb., Fl. Cap. ed. 2: 513 (1823).

Dibrachya peltata (L.) Eckl. & Zeyh., Enum. 1: 74 (1835).

Geraniospermum peltatum (L.) Kuntze, Rev. Gen. 1: 94 (1891).

Pelargonium lateripes auct. mult., non L'Hérit. in Ait., Hort. Kew. ed. 1, 2: 428 (1789).

Pelargonium scutatum Sweet, Geran. 1: 95, t. 95 (1821); DC., Prodr. 1: 666 (1824); G. Don, Gen. Syst. 1: 738 (1831); Steud., Nom. Bot. ed. 2, 2: 289 (1841). Iconotype: Sweet, Geran. 1: t. 95!.

Dibrachya scutata (Sweet) Eckl. & Zeyh., Enum. 1: 74 (1835).

Pelargonium peltatum (L.) L'Hérit. var. *scutatum* (Sweet) Harv. in Fl. Cap. 1: 293 (1860); Knuth in Pflanzenr. 4, 129: 423 (1912). Type: as for *P. scutatum* Sweet.

P. peltatum (L.) L'Hérit. var. *zonatum* DC., Prodr. 1: 666 (1824); G. Don, Gen. Syst. 1: 738 (1831); ex descr. Type: not designated.

Dibrachya clypeata Eckl. & Zeyh., Enum. 1: 75 (1835). Type: Cape, Sondagsrivier, Uitenhage, Ecklon & Zeyher 580 (S, lecto.!, SAM!).

Pelargonium clypeata (Eckl. & Zeyh.) Steud., Nom. Bot. ed. 2, 2: 284 (1841).

P. peltatum (L.) L'Hérit. var. *clypeatum* (Eckl. & Zeyh.) Harv. in Fl. Cap. 1: 293 (1860); Knuth in Pflanzenr. 4, 129: 423 (1912).

P. peltatum (L.) L'Hérit. var. *glabrum* Harv. in Fl. Cap. 1: 293 (1860); Knuth in Pflanzenr. 4, 129: 423 (1912). Syntypes: Cape, Kogmanskloof, Ecklon & Zeyher 578 (S, lecto.!), Hessaquaskloof, Zeyher 2075 (S!).

DESCRIPTION (Fig. 2)

Perennial scrambler, attaining a height of more than 2 m. *Stems* slender, smooth, 3–10 mm in diameter. *Leaves* alternate, sometimes apparently opposite, glabrous to villous, greyish-green to green; lamina shallowly to deeply 5-palmatilobate, cordiform to circular in outline, peltate to pala-



FIG. 2.

Pelargonium peltatum from Dinkie Waterfall near Bourke's Luck, eastern Transvaal (Buitendag 1095). (Illustration by E. Ward-Hilhorst).

ceous, palmately veined, variably succulent, sometimes zoned, apex acute to obtuse, margin entire, (9-)30(-67) \times (18-)50(-87) mm; petiole 5-55 mm long; stipules broadly ovate to deltoid, ca. 4 \times 7 mm. *Inflorescence*: peduncles (40-)65(-85) mm long, glabrescent to pilose; involucre bracts ovate to lanceolate, pilose, ca. 3 \times 2 mm; pseudo-umbels with 2-10 flowers each. *Pedicel* 1.8-5 mm long, pilose. *Hypanthium* (20-)30(-42) mm long, pilose. *Sepals* 5, lanceolate, pilose abaxially, light green to purplish, (7.5-)11(-14) mm long. *Petals* 5, mauve or pinkish-mauve to pale pink or even whitish; posterior two spatulate, sometimes with purple markings, reflexed at ca. 90°, (15-)21(-27) \times (6-)9(-12) mm; anterior three spatulate, slightly reflexed, (13.5-)17(-21) \times (3.5-)6(-7.5) mm. *Stamens* 10, 7(-5) fertile, bases of filaments fused to form a column of ca. 2 mm long, fertile stamens of different lengths but two very short, 2-11 mm long, anthers ca. 2 mm long, purple. *Ovary* ca. 4 mm long, lanate; style ca. 5 mm long, glabrescent to pilose; stigmas 5, ca. 3 mm long. *Mericarps*: base ca. 7 mm long, hirtellous, tail ca. 30 mm long; seeds ellipsoid, ca. 5 \times 2 mm, testa glabrous, brown.

DIAGNOSTIC FEATURES

Perennial scrambler. Lamina shallowly to deeply 5-palmatilobate, cordiform to circular in outline, peltate to palaceous, variably succulent, sometimes zoned. Pseudo-umbels with 2-10 flowers each. Petals 5, mauve or pinkish-mauve to pale pink or even whitish.

GEOGRAPHICAL DISTRIBUTION AND HABITAT

Occurs in the Cape Province, Transkei, Natal and Transvaal, from Wellington in the south west to the Blyderivier in the north, in a strip more or less parallel to the southern and eastern coast (Fig. 3). It is especially common in the Sundays River Scrub, Fish River Scrub, Addo Bush and the southern variation of Valley Bushveld (Acocks, 1975).

Its main flowering period is from October to January but occasional flowers are found almost throughout the year. *Pelargonium peltatum*, which is the ancestor of many garden hybrids of the "ivy-leaved pelargoniums" of today, was introduced into Holland by Wilhelm Adriaen (Willem Adriaan) van der Stel in 1700 and into Britain by Masson in 1774 (Van der Walt, 1977).

DISCUSSION

One of the main problems in this investigation was to decide whether *P. lateripes* should be upheld or not. L'Héritier described *P. lateripes* as having cordate (meaning palaceous) leaves, and *P. peltatum* as having peltate leaves. This criterion was used in subsequent keys as the main distinction

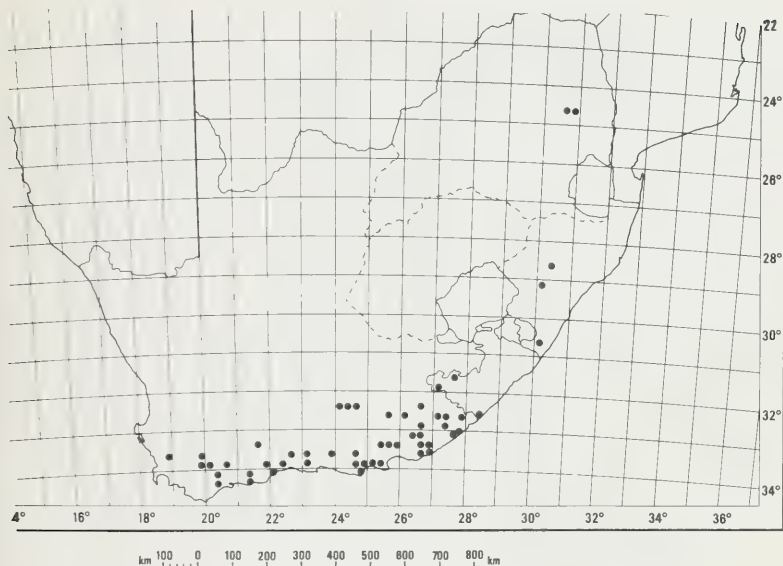


FIG. 3.
Distribution map of *Pelargonium peltatum*.

between these two species. Type material of *P. lateripes* could not be traced, and the origin of the material used for the iconotype plate (Fig. 4) is not known either. In a lengthy description of *Geranium lateripes* (sic) in an unpublished manuscript in the archives of the Conservatory and Botanic Garden Genève, L'Héritier states that this seems to be a hybrid of *Geranium peltatum* (sic).

Examination of live material of *Pelargonium peltatum* from a wide range of localities, grown under uniform conditions, showed that specimens from the western part of the distribution range have typical peltate leaves whereas those with a more eastern and northern distribution have palaceous leaves (Fig. 5). These palaceous forms could easily fit the description of *P. lateripes* but their resemblance to the iconotype plate is not obvious. The possibility is therefore not excluded that L'Héritier used the specific epithet *lateripes* for a hybrid of *P. peltatum* without realising the existence of a palaceous form in nature. Whatever the case may be, both these leaf forms sometimes occur on the same plant. Numerous intermediates also exist, indicating that the two extremes cannot be recognised as separate taxa. This is supported



FIG. 4.
Iconotype plate of *Pelargonium lateripes*. [L'Héritier: *Geranologia*: t. 24 (1792)].

by anatomical studies of leaves which revealed no significant differences. In the light of this and the uncertainty that exists in connection with the type material, it is suggested that the name *P. lateripes* should be excluded and that all those plants with palaceous leaves should be regarded as geographical forms of *P. peltatum*.

Taxa based on zonation as well as on degree of hairiness of the leaves are placed here into synonymy under *P. peltatum*, as it is apparent that these attributes are so variable that it is not worthwhile upholding these taxa. The very hairy specimen from Chalumna Mouth (Vorster 2254) owes this attribute to the small epidermal cells rather than to a high trichome index.

On the whole the leaves are of a succulent nature although the specimens collected at the Kei Mouth (Olivier 2404) appear to be more mesophytic. The shape of the lamina varies from a distinctly five-lobed to an almost unlobed condition (Fig. 5).

From the above it is clear that the marked variation in leaf characteristics which gave rise to this considerable number of taxa, is of a continuous nature. This leads to the conclusion that only one species is involved, of which the correct name is *P. peltatum* (L.) L'Hérit.

EXCLUDED NAMES

Geranium hederinum Andr., Geran. 1: t. 38 (1805). Iconotype: Andr. l.c.!. Garden hybrid.

G. hederinum var. *flore albo* Andr., Geran. 1: t. 40 (1805). Iconotype: Andr. l.c.!. Garden hybrid.

G. hederinum var. *variegatum* Andr., Geran. 1: t. 39 (1805). Iconotype: Andr. l.c.!. Garden hybrid.

G. hederinum var. *zonales* Andr., Geran. 2: t. 88 (1806). Iconotype: Andr. l.c.!. Garden hybrid.

Pelargonium bachmannii Knuth in Pflanzenr. 4, 129: 423 (1912). Type: Cape, Pondoland, *Bachmann 1689*. The original herbarium of Bachmann was destroyed and no duplicate of that number could be traced. Knuth (1912) separated it from *P. peltatum* on the basis of leaf shape. He mentioned that the specimen on which the name is based had no flowers, but that it was closely related to *P. peltatum*. The type specimen *Bachmann 1689* is however also quoted by Knuth (l.c.) under *P. peltatum* var. *clypeatum*.

P. glabrum Hoffmg., Verz. Pfl.: 90 (1824). The possibility of this being the basionym for *P. peltatum* var. *glabrum* was considered. It however appears to be a nomen nudum and is therefore excluded.

P. hederæfolium Salisb., Prodr.: 315 (1796). Superfluous name for *P. lateripes*.

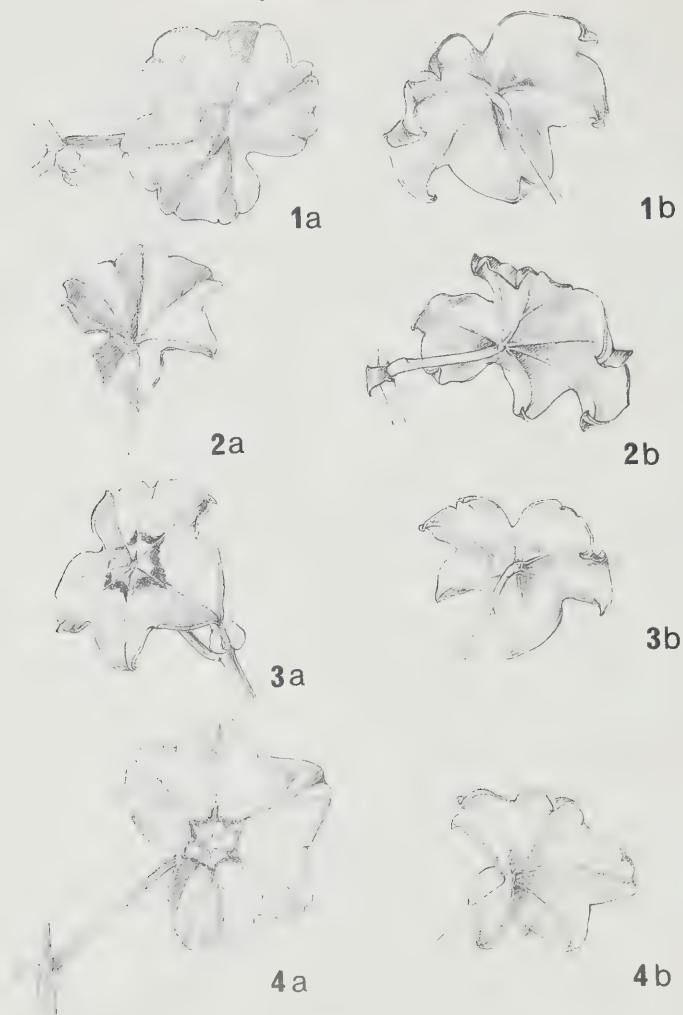


FIG. 5.

Pelargonium peltatum: variation in leaf shape, attachment of petiole and zonation. (Illustrations by E. Ward-Hilhorst).

1 (a & b): Peltate, glabrous, unzoned (Van der Walt 865, near Humansdorp).

2 (a & b): Peltate, glabrous, zoned (Van der Walt 697, Ecce Pass).

3 (a & b): Peltate, glabrous, zoned (Moffett 1027, farm Hounslow between Grahamstown and Fort Brown).

4 (a & b): Peltate, villous, zoned (Fischer 89, King William's Town).



5a



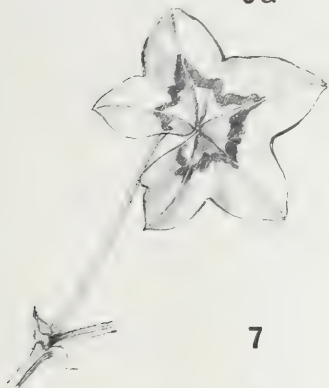
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6a



6b



7



8



9a



9b

- 5 (a & b): Peltate, villous, unzoned (Ward 186, Gonubie River Mouth).
 6 (a & b): Peltate, villous, unzoned (Vorster 2254, Chalumna River Mouth).
 7: Palaceous, glabrous, zoned (Olivier 3026, Gilbert Eyles Dam).
 8: Palaceous, glabrous, unzoned (Van der Walt & Vorster 1339, Kaspersnek).
 9: Palaceous, glabrous, zoned (Schonken 105, Dinkie Waterfall).

P. lateripedatum St. Lag. in Ann. Soc. Bot. Lyon 7: 131 (1880). Superfluous name for *P. lateripes*.

P. lateripes L'Hérit. in Ait., Hort. Kew. ed. 1, 2: 428 (1789); Geran.: t. 24 (1792). Iconotype: L'Hérit. l.c.!. Excluded for reasons given under heading DISCUSSION.

P. lateripes var. *albomarginatum* DC., Prodr. 1: 666 (1824). Type: not designated.

P. lateripes var. *roseum* Sweet, Hort. Brit.: 83 (1826). Type: not designated. Garden hybrid.

P. lateripes var. *viridifolium* Sweet l.c. Type: not designated. Garden hybrid.

P. lateripes var. *walneri* DC., Prodr. 1: 666 (1824). Type: sine loc. et leg. in Herb. DC. (G, holo.!).

P. lateripes var. *zonation* Sweet l.c. Type: not designated. Garden hybrid.

P. peltatum (L.) L'Hérit. var. *superbum* Andr., Geran. 2: t. 107 (1806). Iconotype: Andr. l.c.!. Garden hybrid.

P. peltatum var. *variegatum* Andr., Geran. 1: t. 45 (1805). Iconotype: Andr. l.c.!. Garden hybrid.

P. pinquifolium Sweet, Geran. 1: 52 (1821). Iconotype: Sweet l.c.!. Garden hybrid.

P. saxifragoides N.E. Br. in Gdnrs' Chron. 8: 154 (1890). Type: sine loc., N.E. Brown s.n. (K, holo.!). The original description was based on a garden plant of which the origin is unknown.

SPECIMENS EXAMINED

TRANSVAAL—2430 (Pilgrim's Rest): Kaspersnek (-DA), Van der Walt & Vorster 1339 (STEU); Dinkie Waterfall (-DB), Buitendag 1095 (PRE), Schonken 105 (STEU).

NATAL—2830 (Dundee): 19.2 km from Greyton on Tugela Ferry Road, Umvoti (-CB), Edwards 2527 (NU).

—2930 (Pietermaritzburg): Mooirivier (-AA), Wood 5316 (NH).

—3030 (Port Shepstone): Gilbert Eyles Dam (-CA), Olivier 3026 (PEU).

CAPE—3127 (Lady Frere): Glen Gray Falls (-CC), Galpin 2502 (GRA); Near Cala (-DA), Royffe 179 (GRA).

—3224 (Graaff-Reinet): Mountains W of Graaff-Reinet, kloof leading out of Van Reyneveld's Pass (-AC), Anon. 538 (BOL); Valley of Desolation (-AD), Liebenberg 850 (PRE); Graaff-Reinet (-BC), Thode A553 (PRE).

—3225 (Somerset East): Bosberg (-DA), Olivier 1776 (PEU).

—3226 (Fort Beaufort): Katberg Pass (-BC), Olivier 2406 (PEU); Bedford (-CA), Nicol 66 (Z); SE Koonap (-DC), Blackbeard s.n. (BOL).

—3227 (Stutterheim): Hogsback (-CA), Olivier 2405 (PEU); Ripplemead, Kabousie (-CB), Hutton 503 (NBG); King William's Town (-CD), Fischer 89 (STEU); Komgha (-DB), Flanagan 1161 (GRA, Z).

—3228 (Butterworth): Keimond (-CB), Olivier 2404 (PEU), Van der Merwe s.n. (sub 1240 STEU); Gonubie River Mouth (-CC), Ward 186 (STEU).

- 3318 (Cape Town): Wellington (-DB), *Thompson* 33 (PRE).
- 3319 (Worcester): Koo Mountains (-DB), *Compton* 3924 (BOL); Robertson (-DD), *Galpin* 10338 (PRE).
- 3320 (Montagu): Kogmanskloof (-CC), *D. Boucher* 98 (STEU), *Esterhuysen* 23807 (BOL, PRE), *Leipoldt s.n.* (BOL); Bonnievale, *Marloth* 11829 (PRE); Ashton (-DC), *Marloth* 3266 (STE).
- 3321 (Ladismith): Huisrivier Pass (-BC), *Barker* 20599 (BOL), *Gillett* 4530 (PRE), *Ihlenfeldt* 1637 (PRE); Slangrivier, Swellendam (-DD), *Walgate* 842 (NBG, PRE).
- 3322 (Oudtshoorn): Farm Waenskloof (-CD), *Moffett* 1068 (STEU); George, *Schimper s.n.* (Z); Doornkraal, De Rust (-DA), *Dahlstrand* 2475 (PRE).
- 3323 (Willowmore): Uniondale Hot Springs (-CA), *Esterhuysen* 6282 (BOL, PRE); Road from Klein River to Brandhoek (-CC), *Fourcade* 5490 (STE); Kouga Mountains, NE of Smutsberg, Vleikloof (-DB), *Thompson* 2003 (PRE, STE).
- 3324 (Steytlerville): 27.2 km from Patensie, 1.9 km W of Heronscliff (-DA), *Thompson* 931 (PRE, STE); 8.3 km from Andrieskraal to Humansdorp (-DC), *Thompson* 936 (PRE, STE); 10.7 km from Hankey to Humansdorp Pass (-DD), *Thompson* 914 (PRE, STE); Hankey to Patensie (-DD), *Thompson* 919 (PRE, STE).
- 3325 (Port Elizabeth): Kirkwood, Uitenhage dist. (-AD), *Taylor* 4145 (NBG, STE); Zuurberg Pass (-BC), *Barker* 4923 (NBG); Addo Park (-BD), *Van der Walt* 873 (STEU), *Brynard* 203 (PRE), *Liebenberg* 6275 (PRE), *Olivier* 550 (GRA); Van Stadens Pass (-CC), *Olivier* 1906 (PEU); Uitenhage (-CD), *Ecklon & Zeyher* 181 (PRE); Springs Reserve, Uitenhage, *Olivier* 1990 (PEU); Markham Industrial Area (-DC), *Dahlstrand* 1770 (PRE, STE); Berg River, Thornhill, *Dix* 122 (BOL); Baakens River, Fern Glen, *Olivier* 1224 (NBG, PEU, PRE), *Van der Walt* 567 (STEU); Blue Water Bay, *Olivier* 1696 (PEU); Redhouse, *Paterson* 230 (BOL).
- 3326 (Grahamstown): Carlisle Bridge (-AB), *Taylor* 4284 (NBG); Farm Hounsflow on the way to Fort Brown (-BA), *Moffett* 1027 (STEU); Grahamstown (-BC), *Bayliss* 123 (PRE), *Dyer* 2091 (PRE); 18.9 km from Grahamstown on Port Elizabeth road, *Brink* 476 (GRA); 32 km S of Grahamstown, *Heginbotham* 200 (NBG); 12 km from Grahamstown on Port Elizabeth road, *Olivier* 1911 (PEU); Between Grahams-town and Fort Beaufort, *Van der Walt* 697 (STEU), *Werdermann & Oberdieck* 1046 (PRE); Fraser's Camp (-BD), *Maguire* 635 (NBG); Kenton-on-Sea (-DA), *Bayliss* 1886 (NBG, Z); Kasouga Mouth, *Britten* 2326 (PRE); Bathurst, Southwell, *Schonland* 3319 (GRA); Boesmansriviermond, *Van der Walt* 695 (STEU); Port Alfred (-DB), *Burt Davy* 7899 (E), *Compton* 21085 (NBG), *Moffett* 1025 (STEU); Farm Peninsula, *Fletcher* 81 (GRA); Bathurst, *Sidey* 3160 (PRE).
- 3327 (Peddie): East London (-BA), *Rattray* 289 (GRA); Chalumna River Mouth, *Vorster* 2254 (PRE); Buffalo Pass, East London (-BB), *Compton* 17784 (NBG).
- 3420 (Bredasdorp): Swellendam (-AB), *Marloth* 8630 (PRE); E of Bushman's River, Swellendam, *Martin* 666 (NBG); Wydgelegen (-AD), *Compton* 19509 (NBG).
- 3421 (Riversdale): Kafferkuils River, Riversdale (-AB), *Muir* 419 (PRE), *Schlechter* 1966 (W, Z); Stilbaai (-AD), *Johnson* 105 (NBG), *Nel s.n.* (STE); Muis-kraal, Gouritz River bridge (-BA), *Van der Walt* 834 (STEU).
- 3422 (Mossel Bay): Mossel Bay (-AA), *Duthie s.n.* (STE), *Guthrie* 4285 (NBG), *Marloth* 2454 (PRE), *Penther* 2196 (W), *Rogers* 23284 (PRE), *Rogers* 27160 (Z); Grootbrakrivier, *Galpin* 3825 (PRE); Kleinbrakrivier, *Taylor* 6979 (PRE), *Van der Walt* 670 (STEU); 7.5 km W of Grootbrakrivier bridge, *Taylor* 8320 (PRE, STE); Between Grootbrak- and Kleinbrakrivier, *Taylor* 7814a (PRE); Ruigtevlei (-BB), *Fourcade* 1555 (BOL, GRA, PRE, STE).
- 3424 (Humansdorp): Jeffrey's Bay (-BB), *Duthie s.n.* (STE), *Hutchinson* 1447 (BOL, PRE); Seekoei River, *Montgomery* 27 (STE); 20 km from Humansdorp, *Van der Walt* 865 (STEU).

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A REVISION OF *HESPERANTHA* (IRIDACEAE) IN THE WINTER RAINFALL AREA OF SOUTHERN AFRICA¹

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ABSTRACT

Hesperantha, a genus of Iridaceae–Ixiodeae, comprises some 55 species occurring in Africa south of the Sahara. Its centre is in the winter rainfall area of southern Africa, where 36 species are recognised. A further approximately 20 species occur north eastward from the Transkei to Ethiopia, with a marked secondary centre in the Drakensberg of Natal–Lesotho. In the winter rainfall area, species are concentrated in the western Cape Floristic Region and adjacent western Karoo, with decreasing representation north into Namaqualand and east through the southern Cape to the Grahamstown district where species of the winter and summer rainfall areas meet. The genus is closely related to *Geissorhiza*, a predominantly Cape genus of some 70 species. *Hesperantha* is defined by its characteristic style, which typically divides at the apex of the perianth tube (rarely within the tube) into three long spreading branches, often longer than the style itself. It is basically moth-pollinated, most species having small, pale-coloured flowers that open in late afternoon and close some time during the night, but several species are brightly coloured and are day blooming. The genus exhibits a wide range of variation in corm types in the winter rainfall area and these organs are important in the infrageneric classification adopted here. Variation in floral characters is relatively limited. Of the species recognised here, 16 only were included (two as *Geissorhiza*, one as *Tritonia* and one as *Syringodea*) in *Flora Capensis* (1896), the only comprehensive treatment of southern African Iridaceae. Three more admitted in *Flora Capensis* have been reduced to synonymy and one to subspecies rank.

Fourteen species are described here for the first time. Basic chromosome number is $x = 13$, and only diploids have been recorded in the winter rainfall area, where some 25 species have been counted.

UITTREKSEL

'N HERSIENING VAN *HESPERANTHA* (IRIDACEAE) VAN DIE WINTER-REËNVALSTREEK VAN SUIDELIKE AFRIKA

Hesperantha, 'n genus van die Iridaceae–Ixiodeae, bestaan uit sowat 55 soorte wat in Afrika suid van die Sahara voorkom. Die sentrum van verspreiding is die Winterreënvalstreek van suidelike Afrika waar 35 soorte erken word. 'n Verdere 20 soorte kom noord-ooswaarts vanaf die Transkei tot in Ethiopië voor met 'n opmerklike konsentrasie in die Natal–Lesotho Drakensberge. In die Winterreënvalstreek is die soorte gekonsentreerd in die westelike gedeelte van die Kaapse Floristiese Streek

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en die aangrensende westelike Karoo, met 'n dalende teenwoordigheid noordwaarts in Namakwaland en ooswaarts deur die Suid-Kaap tot die Grahamstad-distrik waar die soorte van die Winter- en Somerreënvallstreek ook aangetref word. Die genus is naverwant aan *Geissorhiza*, 'n oorwegend Kaapse genus van sowat 70 soorte. *Hesperantha* word onderskei deur 'n kenmerkende styl wat tipies verdeel by die bo-punt van die blomdekbuis (met uitsondering binne in die buis), in drie wydverspreide takke, meestal langer as die styl self. Dit word normaalweg deur motte bestuif en meeste soorte het klein, bleek blommetjies wat in die laat namiddag oopgaan en een of ander tyd in die nag toegaan. Sommige soorte is helderkleurig en gaan gedurende die dag oop. Die groot variasie in knoltipes en organe wat in die genus aangetref word, is belangrik vir die infra-generiese klassifikasie soos hier voorgestel. Variasie in blomkenmerke is relatief beperk. Van die soorte hier erken word net 16 (twee *Geissorhiza*, een *Tritonia* en een *Syringodea*) in *Flora Capensis* (1896), die enigste omvattende verhandeling van suider-Afrikaanse Iridaceae, beskryf. Drie *Flora Capensis*-soorte is verlaag tot sinonieme en een tot 'n subspesie.

Veertien soorte word vir die eerste keer hier beskryf. Die basiese chromosoomgetal is $x = 13$ en almal van die sowat 25 Winterreënvallstreeksoorte waarvan die chromosome getel is, was diploïed.

Key words: *Hesperantha*, sp. nov., sect. *Concentrica*, sect. *Hesperantha*, sect. *Radiata*, sect. *Imbricata*, Iridaceae, south western Cape, Namaqualand, Karoo, chromosome cytology, phylogeny.

INTRODUCTION

Hesperantha is a genus of some 55 species, occurring in Africa, south of the Sahara. Distribution is restricted to temperate, montane habitats in tropical Africa, and the concentration of species increases in southern Africa where the primary centre is the winter rainfall area of the south and west coast and a secondary centre is located in the Drakensberg of Natal, Lesotho and Transkei, a summer rainfall area. The genus has been treated only once for all of southern Africa, in *Flora Capensis* (Baker, 1896) in which 26 species were recognised, 16 in the winter rainfall area, while four more were placed in *Geissorhiza*, *Tritonia* or *Syringodea*. Several more were added subsequently, most recently by Foster (1948) who described ten new species and made substantial changes to the nomenclature in a preliminary systematic study (eight are treated here as synonyms of earlier species). In his study Foster provided no keys, and did not deal at all with several well-known species.

The present revision, which treats only the species of the winter rainfall regions of the Cape, Namaqualand and the adjacent parts of the western and southern Karoo, includes the majority of the species in the genus, and also most of the infrageneric variation in *Hesperantha*. The winter rainfall region of the Cape Province is clearly the major centre for the genus and an area where considerable recent speciation has occurred. I hope in a future paper to revise the genus in tropical and eastern southern Africa, following studies by Hilliard & Burtt (1979; 1982; in prep.) of *Hesperantha* in the Drakensberg area of Natal and Lesotho. In the formal taxonomic treatment, 36



FIGS 1-6.

From left to right and top to bottom. Fig. 1. *Hesperantha vaginata*, Perdekraal, Calvinia; Fig. 2. *H. bachmannii*, Citrusdal; Fig. 3. *H. cucullata*, Nieuwoudtville, early evening display; Fig. 4. *H. pauciflora*, Kamiesberg; Fig. 5. *H. luteicola*, Middelpos; Fig. 6. *H. elsiae*, Cedarberg; note the included anthers and style branches.

species are recognised, 14 of which are new species. Most of these were discovered in the years following Foster's (1948) study, partly as a result of the extensive exploration of the Cape mountain flora by Elsie Esterhuysen, whose contribution to our botanical knowledge of this region is without parallel. Three species were discovered by myself, two of these, *H. purpurea* and *H. quadrangula*, during the course of this study.

RELATIONSHIPS

Hesperantha, a member of the predominantly African subfamily Ixioidae, is generally recognised as being closely allied to the large, mainly Cape genus, *Geissorhiza* (ca. 70 spp.) (Lewis, 1954; Goldblatt, 1971) and the two are often confused. Species of these genera are superficially alike, being similar in size, in general appearance, and in having globose corms with woody tunics. The concentric corm tunics of *Hesperantha* section *Concentrica* and of *Geissorhiza* subgenus *Weihea* are in fact identical (Goldblatt, in prep.). Members of other sections of *Hesperantha* and of subgenera of *Geissorhiza* have different and often distinctive corm tunics. The important difference, however, between *Hesperantha* and *Geissorhiza* is in the structure of the style. Typically the style of *Hesperantha* is divided at the apex of the well-developed perianth tube, and the style branches are long and rather irregularly spreading. In *Hesperantha saldanhae*, *H. elsiae* and *H. cedarmontana*, the style divides well within the tube and in the last mentioned, the branches may not emerge at all.

In contrast, the style of *Geissorhiza* is typically long, and well exerted from the usually very short perianth tube, and has short, recurved branches. Exceptions are *G. spiralis* (Burchell) de Vos and *G. corrugata* Klatt with relatively long style branches that divide a short distance beyond the mouth of a wide perianth tube; and *G. cedarmontana* Goldbl. ined. and *G. esterhuyseniae* Goldbl. ined. in which the remarkably short style and style branches are included in the lower part of a long perianth tube. These species can only be distinguished from *Hesperantha* by several associated characters of bract and leaf structure.

It seems very likely that *Hesperantha* and *Geissorhiza* arose from a common ancestor with a concentric type of corm tunic, and that the two diverged along different lines, *Hesperantha* being primarily specialised for moth pollination, with its pale, scented, night-blooming flowers and well-developed perianth tube, and *Geissorhiza* primarily bee-pollinated and day-blooming with brightly coloured, scentless flowers and typically short perianth tube.

The monotypic southern African *Schizostylis* matches *Hesperantha* in all respects except in its rootstock, a rhizome-like structure. *Schizostylis* is

aquatic or semi-aquatic and may be secondarily rhizomatous, with the corm degenerate because of its moist habitat. Corm-like structures are produced from the above-ground internodes of *Schizostylis*.

Hesperantha, *Schizostylis*, and *Geissorhiza* have a common basic chromosome number and karyotype, with $x = 13$. These three genera, together with the monotypic *Melasphaerula* ($n = 11$), were united in subtribe Hesperanthinae (Goldblatt, 1971) and are apparently mostly closely related to Gladiolinae ($x = 15$), sharing with this subtribe undivided style branches and primitively herbaceous bracts. Relationships of genera of Ixiodeae are, however, difficult to assess at present and detailed tribal and infratribal classification is highly speculative and perhaps premature.

TAXONOMIC HISTORY

The first few species of *Hesperantha* to be recorded were all from the south western Cape, having been collected by botanists and explorers based at the Dutch settlement at Cape Town. Like other species of Iridaceae with more or less actinomorphic, stellate flowers, and spicate inflorescences, they were initially assigned to *Ixia*, or occasionally to *Gladiolus*. N. L. Burman has the distinction of having formally described the first species of *Hesperantha*, namely *H. spicata*, as *Ixia spicata* (Burman, 1768). The source of Burman's specimens is unrecorded. During the later Linnaean period, the Swedes Anders Sparrman and Carl Peter Thunberg, both living at the Cape for some time, collected several more species, and Thunberg's collections and manuscripts formed the basis for three species of *Hesperantha* first briefly described by the younger Linnaeus in 1782, as *Ixia falcata*, *I. pilosa* and *I. cinnamomea*, the later identical with Burman's *I. spicata*. Subsequently, Thunberg in 1783, published more complete descriptions of these species, and a fourth, *Hesperantha radiata*, which he misidentified as *Gladiolus recurvus* L. (Thunberg, 1784).

At about the same time Nicholas Jacquin, working in Vienna, was acquiring South African plants from two poorly-known collectors, Francis Boos and George Schol (Garside, 1942). Jacquin grew and, subsequently, figured *Hesperantha radiata* and *H. falcata*, naming the former *Ixia radiata* and the latter *I. linearis* (a homonym) which he soon changed to *I. angusta* (Jacquin, 1793).

Hesperantha was only recognised as a genus distinct from *Ixia* at the beginning of the nineteenth century when Ker (1805) segregated from this large and diverse genus not only *Hesperantha* but *Geissorhiza*, *Tritonia*, *Sparaxis* and *Romulea* (as *Trichonema*). Ker admitted to *Hesperantha* all the species then known, although he was evidently unaware of Burman's earlier name *I. spicata* for *H. cinnamomea*. Ker recognised as distinct both *H. fal-*

TABLE 1.

The species of *Hesperantha* of the winter rainfall area of southern Africa, arranged in systematic order by section, with summary of their distribution ranges.

Section <i>Concentrica</i>		
1.	<i>H. erecta</i> (Baker) Benth. ex Baker	west coast, Mamre to lower Olifants River
2.	<i>H. namaquana</i> Goldbl.	S Namaqualand, Bitterfontein to Nuwerus
3.	<i>H. acuta</i> (Licht. ex Roem. & Schult.) Ker	Worcester to George, W and S Karoo
4.	<i>H. montigena</i> Goldbl.	western Cape mts, at high altitudes
5.	<i>H. pilosa</i> (L.f.) Ker — subsp. <i>pilosa</i> — subsp. <i>latifolia</i> Goldbl.	W Cape, Caledon-Nieuwoudtville, Roggeveld Roggeveld escarpment north to Kliprand
6.	<i>H. ciliolata</i> Goldbl.	Sneeukrans, Roggeveld escarpment
7.	<i>H. rivulicola</i> Goldbl.	Calvinia district, along streams
8.	<i>H. quadrangula</i> Goldbl.	Hantamsberg massif, Calvinia
9.	<i>H. flexuosa</i> Klatt	Namaqualand
10.	<i>H. minima</i> (Baker) Foster	Kamiesberg, Namaqualand
11.	<i>H. fibrosa</i> Baker	SW Cape, Houw Hoek to Heidelberg
Section <i>Imbricata</i>		
12.	<i>H. longituba</i> (Klatt) Baker	eastern Karoo and eastern Cape
13.	<i>H. cucullata</i> Klatt	western Karoo, Nieuwoudtville to Roggeveld
14.	<i>H. vaginata</i> (Sweet) Goldbl.	Calvinia district
15.	<i>H. karooica</i> Goldbl.	foot of the Hantamsberg, Calvinia
16.	<i>H. humilis</i> Baker	Roggeveld and Witteberg
17.	<i>H. flava</i> Lewis	Matjiesfontein Karoo and N Namaqualand
18.	<i>H. hantamensis</i> Schltr. ex Foster	Calvinia district
19.	<i>H. purpurea</i> Goldbl.	western Karoo NW of Calvinia
20.	<i>H. oligantha</i> (Diels) Goldbl.	Hantamsberg massif
21.	<i>H. pallescens</i> Goldbl.	lower S slopes, Olifants River Mts
22.	<i>H. bachmannii</i> Baker	widespread, Namaqualand, W karoo, W to E Cape
23.	<i>H. bulbifera</i> Baker	Somerset East (and Transvaal), montane in cliffs
Section <i>Hesperantha</i>		
24.	<i>H. falcata</i> (L.f.) Ker	widespread, Lokenburg to Port Elizabeth
25.	<i>H. cedarmontana</i> Goldbl.	higher altitudes, W Cape mts, Pakhuis to Piketberg
26.	<i>H. pauciflora</i> Lewis	Nieuwoudtville escarpment and Namaqualand
27.	<i>H. latifolia</i> (Klatt) De Vos	Kamiesberg, Namaqualand, shallow pools
28.	<i>H. luticola</i> Goldbl.	Roggeveld escarpment to Hantamsberg, wet sites
29.	<i>H. spicata</i> (Burm.f.) N.E. Br. — subsp. <i>graminifolia</i> (Sweet) Goldbl.	Cape Peninsula to Wolseley, sandy soils

— subsp. <i>spicata</i>	Cape Peninsula to Piketberg, mainly clay soils
— subsp. <i>fistulosa</i> (Baker) Goldbl.	Porterville district, wet flats
30. <i>H. saldanhae</i> Goldbl. Section <i>Radiata</i>	Saldanha district, Vredenburg granite outcrops
31. <i>H. brevifolia</i> Goldbl.	western Cape mts, Worcester to Piketberg
32. <i>H. radiata</i> (Jacq.) Ker	widespread, Namaqualand to Swaziland
33. <i>H. marlothii</i> Foster	Roggeveld escarpment to Nieuwoudtville
34. <i>H. muirii</i> (L. Bolus) Lewis	S Cape, Bredasdorp to Albertinia
35. <i>H. juncifolia</i> Goldbl.	S Cape, Agulhas Peninsula, on limestone
36. <i>H. elisiae</i> Goldbl.	Cedarberg Mts near Krom River

cata, and *H. angusta*, which are now believed to be conspecific (see discussion under *H. falcata*). Ker included one undescribed species, *H. virginea*, a nomen nudum, never subsequently validated, which is probably what is now known as *H. bachmannii*. Thus by 1805, six species of *Hesperanthes*, all Cape species, were known to science.

During the early nineteenth century, the German explorer Lichtenstein collected the first specimens of *Hesperanthes acuta*, described later by Roemer & Schultes (1817) as *Ixia acuta* while the Englishman, William Burckell, collected several species of *Hesperanthes*, including *H. humilis*, *H. acuta*, and the common *H. radiata* in the interior, in the western Karoo. *H. humilis*, however, remained undescribed until much later (Baker, 1876). The taxonomically much-confused, yellow and black-flowered *Hesperanthes vaginata* (Goldblatt & Barnard, 1970) was also described during this period by Robert Sweet who assigned it to *Geissorhiza* (Sweet, 1826). The original collector of the plants grown in England is unrecorded. Curiously, this striking species was not found again for almost 100 years. It was rediscovered on the Nieuwoudtville escarpment in the 1920's, and described as *H. metelerkampiae* (Bulus, 1927), while a clear yellow form was named *H. stanfordiae* shortly afterwards (Bulus, 1931).

The active collecting of the late 1820's and 1830's by Drège and by Ecklon & Zeyher produced numerous new species of *Hesperanthes*. The range of the genus was extended by Drège to Namaqualand (where he collected *H. flexuosa*, *H. erecta*, *H. minima* and *H. latifolia*) while both Drège and Ecklon & Zeyher recorded the genus at the edge of the summer rainfall area in the eastern Cape. Here they collected *H. longituba* near Aliwal North and Drège found *H. disticha* (probably conspecific with *H. baurii*) along the Umtata River. These collections were neglected for several years, and only after 1865 did Klatt, and then Baker, begin to describe the new taxa lying in European herbaria. Klatt described six species of *Hesperanthes* (in which he included some species of *Geissorhiza* as well) in the years

1866–1882, assigning *H. longituba* to *Geissorhiza* and the long-tubed, and stemless, *H. latifolia* to *Syringodea* from which it was only removed by De Vos in 1974. Klatt dealt not only with Drège and Ecklon & Zeyher collections, but with specimens gathered by the British collectors Thomas Cooper and James Bowker and by German botanists who collected in the north west Cape.

Strangely enough, before *Hesperantha* was reported in the literature as occurring beyond the confines of the southern African winter rainfall area, the genus was collected north of the equator, in Ethiopia, by Schimper in 1844, whose collections of *H. petitiiana* were described variously as *Ixia petitiiana* and *I. hochstetteriana* shortly afterward (Richard, 1850).

During the later third of the nineteenth century, botanical exploration in southern Africa, notably at the Cape and in Natal, by among others Harry Bolus, Peter MacOwan, John Medley Wood and Rudolph Schlechter, produced a number of new species, or what were thought to be new species. This new material was largely described by J. G. Baker in Britain, although many of the new species found by Schlechter were only described in 1948 by R. C. Foster, who took up many of Schlechter's manuscript names.

Collecting was extended within the winter rainfall area during the 20th century into several areas largely overlooked by the earlier collectors. Rudolf Marloth made important collections in the Roggeveld and Cold Bokkeveld, H. H. W. Pearson explored Namaqualand, while H. M. L. Bolus and her students surveyed the Bokkeveld (Van Rhyns Pass) escarpment and R. H. Compton the Witteberg and adjacent area. By the mid-1930's, almost all of the low and mid-altitude species had been discovered, though not always named, and those not described by H. M. L. Bolus and G. J. Lewis were named by R. C. Foster (1948) in his incomplete study of the genus.

The higher altitude species remained unknown until Elsie Esterhuysen, and amateurs such as Ernest Galpin and Thomas Stokoe began to survey the flora of the higher Cape Mountains. Esterhuysen discovered two of the new species described here for the first time, *H. elsiae* and *H. montigena*, and has made the main collections of a third, *H. cedarmontana*. Surprisingly, in spite of over two hundred years of plant exploration in the relatively small area of the winter rainfall area of South Africa, new species continue to be discovered. The only known collections of *H. luticola*, *H. karooica*, *H. ciliolata*, *H. saldanhae*, *H. juncifolia*, *H. purpurea* and *H. quadrangula* were all made in the last two decades. These recently discovered species have, as might be expected, fairly limited ranges and it seems likely that still more species remain to be found.

GEOGRAPHY OF *HESPERANTHA* IN THE WINTER RAINFALL AREA

The southern African winter rainfall region extends along the west coast from southern Namibia to Cape Point, and along the south coast to Port Elizabeth (Fig. 7). The eastern half of the south coast belt receives substantial summer precipitation, and is often regarded as a region of year-round rainfall. Inland, the winter rainfall belt extends to the edge of Bushmanland and into the western Karoo and in the south, to the Swartberg Mountains. Higher areas of the eastern Karoo also receive winter precipitation and here, as well as in the southern Cape, species of *Hesperantha* are spring-blooming, in response to the winter rains.

Species of *Hesperantha* occur almost throughout this area, but none have been recorded north of the Orange River, in Namibia. Of the 36 species



FIG. 7.
Concentration of species of *Hesperantha* in the winter rainfall area of Southern Africa and adjacent Karoo. The numbers indicate the total species recorded in each geographical degree square.

treated here two, *H. longituba* and *H. bulbifera*, occur only in the eastern Karoo and eastern Cape, essentially on the edges of the true winter rainfall belt, and are included here for convenience. Thus 34 species occur in the winter rainfall belt in a strict sense, and of these 32 occur exclusively in this area, while *H. bachmannii* and *H. radiata*, extend to the east into summer rainfall southern Africa. *Hesperantha bachmannii*, extends only along the coast as far as East London, but *H. radiata* (often treated as *H. tysonii* outside the winter rainfall area) occurs widely in the eastern Karoo, Transkei, and Drakensberg as far north as Swaziland. Strangely, these two species are also the most widespread within the winter rainfall area. *H. radiata* is ubiquitous and *H. bachmannii* almost so, but does not occur in the areas of highest rainfall and is absent from the Caledon and Cape Town districts.

The concentration of species is highest in the west (Fig. 7) indicating substantial radiation in this semi-arid, and summer dry area of rugged and varied landscape. Concentration falls sharply in the far north, where the climate is most arid, and in the eastern southern Cape where the climate is most equable.

Centres of Endemism

Calvinia District and the Nieuwoudtville Plateau: the area of highest species concentration is the Calvinia district. A total of seventeen species occur in the Calvinia grid 3119, of which seven species are endemic. In the eastern part of this grid, in the area immediately around the Hantamsberg, eleven species of *Hesperantha* grow and *H. hantamensis*, *H. purpurea*, *H. oligantha* and *H. karooica* (all section *Imbricata*) and *H. quadrangula* are endemic to this small area. *Hesperantha vaginata* and *H. rivulicola* extend from Calvinia to the western half of this grid, where *H. vaginata* is particularly common around Nieuwoudtville. West of Nieuwoudtville several more species are found in the northern tongue of the Cape Floristic Region that occurs on the sandstone soils of this area, including *H. falcata* and *H. marlothii*.

The Western Karoo: the western Karoo between Calvinia and Sutherland appears to constitute a second important area for speciation in *Hesperantha*. In addition to the endemic species mentioned for the Hantamsberg area around Calvinia, three species, *H. luticola*, *H. marlothii* and *H. humilis* are centred here (*H. marlothii* has one record from the Cold Bokkeveld to the west, while *H. humilis* occurs in the Witteberg to the south). *Hesperantha pilosa* subsp. *latifolia* is endemic in the western Karoo, while *H. ciliolata* is a local endemic found only in the Sneeukskrans area of the escarpment north west of Sutherland. In all, some 18 species occur in the parts of grids

3119, 3120 and 3220 that constitute the western edge of the Karoo and of these nine are endemic here.

The Cedarberg, Cold Bokkeveld, Piketberg Mountain Centre: significant radiation has also occurred in the mountains to the west, in the Cold Bokkeveld, Olifants River, Cedarberg Mountain axis. Nine species occur in grid 3219 which constitutes most of this mountain belt and if the mountains of the eastern half of the adjacent grid are considered, a total of 12 species occurs in this mountain belt that forms the inland portion of the western half of the Cape Floristic Region. Three species are endemic in this area: *H. elsiae*, local in the southern Cedarberg, *H. pallescens* from the lower southern slopes of the Olifants River Mountains and *H. cedarmontana* which occurs at higher elevations in the Cedarberg and Pakhuis Mountains as well as on the Piketberg.

Western Cape Coast: most species of the western coastal belt of the Cape Flora Region are widespread, occurring elsewhere as well, but *Hesperantha erecta* is restricted here, extending from the Olifants River in the north to the Darling area. *Hesperantha spicata* is nearly restricted to this coastal belt but occurs on the Piketberg, and inland locally as well, but *H. spicata* subsp. *graminifolia* is endemic in the southern end of the coastal belt while *H. saldanhae* is a rare local endemic of the Saldanha Bay area.

Namaqualand: to the north in Namaqualand, the widespread *Hesperantha radiata* and *H. bachmannii* are fairly common and extend into the Richtersveld, but throughout this very arid area *H. radiata* is usually associated with moist habits, such as seeps or stream banks. In addition, there are four endemics in Namaqualand. *Hesperantha flexuosa* ranges from the Kamiesberg north to Steinkopf, *H. latifolia* is restricted to the Kamiesberg, both at high altitudes on the Rooiberg and at lower elevations such as Grootvlei, *H. minima*, a dwarf species, has been collected only once, on the Kamiesberg, by Drège in the 1830's, and *H. namaquama* is restricted to the hills between Bitterfontein and Nuwerus. A further two species occur in Namaqualand, *H. pauciflora* and *H. flava*, and both have unusual, disjunct ranges. *Hesperantha pauciflora* occurs in the Kamiesberg-Kamieskroon area, and on the Nieuwoudtville escarpment some distance to the south, while *H. flava* occurs on the shale outcrops of the Nama System near Steinkopf, and near Matjiesfontein in the south western Karoo. Both disjunctions are without parallel in Iridaceae.

The Southern Cape: in the southern Cape, *Hesperantha juncifolia* is the only local endemic. It has been collected only once, on limestone along the Agulhas coast. There are two more endemics in this area and these occur in the western and driest part of the southern Cape: *H. fibrosa* extends from Caledon to near Heidelberg, and *H. muiirii* occurs from Bredasdorp to

Albertinia. The widespread *H. falcata*, *H. bachmannii* and *H. radiata* occur throughout the southern Cape, and in the east are the only common species, but the eastern Karoo species *H. longituba* occurs locally in dry sites and in the interior.

In summary, the western part of the southern African winter rainfall area is the centre for great radiation in *Hesperanthes*. Within the region are several subcentres, each with endemic species. The western Karoo stands out as most significant with 18 species and nine endemics. Next in importance is the western Cape mountain belt of the Cedarberg, Pakhuis, Cold Bokkeveld and Olifants River Mountains as well as the Piketberg, with eleven species and three endemics. Nine species and four endemics occur in Namaqualand, eight species and two endemics occur in the western Cape coastal belt and in the western end of the southern Cape there are seven species and three endemics. Ten species have been recorded in the mountains of the south western Cape, including the Du Toits Kloof, French Hoek, Hex River and Riviersonderend Mountains of which only the sub-alpine *H. montigena* is endemic.

ECOLOGY

Species of *Hesperanthes* are typically small to very small plants and they form a minor component of the floral communities in which they occur. Plants are rarely noticeable unless they are in full bloom and then become conspicuous for a brief two or three weeks in the year. Most often, species grow in habitats where they are unlikely to be completely overgrown by surrounding vegetation. Such places include areas of thin, particularly stony, soils, or in very rocky situations where few plants can survive or grow to appreciable size. Several species occur exclusively or predominantly in such situations, particularly in a habitat that may be called a rock seep or rock flush (Goldblatt, 1979). These are more or less flat rock outcrops on which a thin layer of soil accumulates and in the wet season remains permanently moist as water percolates over the rocks. Species of several genera of Iridaceae occur in this habitat, some restricted to these sites, especially in the genus *Galaxia* (Goldblatt, 1979). *Hesperanthes latifolia* and *H. montigena*, both montane species, are restricted to this habitat while *H. cedarmontana* grows in similar situations, but generally on the south side of boulders, and in crevices where roots penetrate to deeper levels.

Hesperanthes luticola and *H. marlothii* of the Nieuwoudtville escarpment and western Karoo may be found in rock flush habitats, but they also occur on deeper soils in waterlogged and/or stony situations. The dwarf *H. luticola* blooms unusually early in the season, often in June or July, when the soil is still waterlogged and the surrounding vegetation has not begun spring

growth. A few other species may occasionally be found in rock flush habitats, although they are typical of deeper soils: these include *H. pilosa* and *H. pauciflora*.

On deeper soils, species of *Hesperantha* occur on various substrates, but are seldom restricted to a particular soil type. Those species characteristic of the coarse, nutrient-poor sandy soils of the Cape System tend to be markedly fire-responsive, blooming only after fire has destroyed the typically dense sclerophyllous (fynbos) vegetation which forms the climax on such soils. *Hesperantha falcata*, *H. brevifolia*, *H. radiata*, *H. pilosa* and *H. spicata* are the most common species in this habitat, and they generally appear in profusion after fires. *Hesperantha radiata*, *H. pilosa* and *H. spicata* also occur on clay and shaley soils where plant communities are usually shorter and less dense and then bloom regularly, although they do benefit from clearing or heavy grazing of the surrounding bush. The South Cedarberg endemic, *H. elsiae*, also occurs on poor sandy mountain soil, but it apparently flowers well in the absence of fire.

Three species are restricted to clay soils in the south western Cape: *H. pallescens*, *H. fibrosa* and *H. muirii*. In the western Karoo the acaulescent *H. humilis*, *H. flava* and *H. hantamensis* occur on the characteristic shaley soils of this area where plant cover is sparser than in the south western Cape. In the western Karoo, two species, *H. vaginata* and *H. purpurea*, are restricted to local outcrops of heavy red fine-grained clay, either amongst rocks or in the open.

A few species grow on unusual substrates. These include *H. erecta* and the very local *H. saldanhae*, which are apparently restricted to granitic outcrops, where they grow in shallow soils among boulders. *Hesperantha juncifolia* is endemic on limestone and has only been recorded from one site on the Agulhas coast where limestone is common.

Within the winter rainfall area, *Hesperantha radiata* is notable for the diversity of situations in which it occurs. It is equally common on sandy flats, in stony, montane habitats or on clay soils among dwarf shrubs. In the extreme north of its range in Namaqualand, it is restricted to moister situations, while in the summer rainfall area it also grows in wet sites, either bogs, stream banks or seepage lines.

FLORAL PHENOLOGY

Flowers of species of *Hesperantha* usually last for two to four days, but exhibit characteristic diurnal rhythms of opening and closing. In general, the white or pale-coloured species are evening-blooming, and their flowers open and produce a strong scent in late afternoon to early evening and close later

during the night. The first of these to open are the flowers of *H. falcata* (white-flowered forms), *H. bachmannii* and *H. cucullata*, which begin to unfold at about 17h00 (sometimes earlier), while flowers of *H. cedarmontana*, *H. pilosa*, *H. rivulicola* and others do not open until nearly dark after 18h30. The evening-blooming species often produce a spectacular display towards early evening when they are conspicuous in the failing sunlight. Such species are widely believed to be moth-pollinated (Vogel, 1954) but there are no critical observations on this subject. Marloth (1915: 145) comments that the early-blooming *H. falcata* is visited by moths, and this is illustrated in Fig. 42A (vol. 4, *Flora of South Africa*). Vogel (1954: 103) considers *Hesperantha* to be fundamentally a moth-pollinated genus.

Species or populations of species with coloured flowers are, in contrast, day-blooming and scentless, and their flowers close towards evening. Flowering times are characteristic for a species. The flowers of the blue and purple-flowered populations of *Hesperantha pilosa* in the Nieuwoudtville area and in the Roggeveld open shortly after dawn and close at about 13h00. More commonly, coloured flowers open at about 11h00, when temperatures are warm, and then close between 16h00–17h00. *Hesperantha pauciflora* is unusual in having flowers that only open after noon and close between 16h00 and 16h30. A species with an even shorter flowering time is *H. vaginata*, the yellow and black (rarely clear yellow) flowers of which open at about 15h00 and close toward 18h00. Vogel (1954) speculates that such species are bee-pollinated, but no observations have been recorded. The bright yellow and long-tubed flowers of *H. flava* are apparently unusual in being evening-blooming. Vogel (1954: 104) reports that this species is pollinated by hawk moths and he suggests that other long-tubed evening-blooming species (e.g. *H. longituba*, *H. pulchra*) may also be pollinated in this way.

The diurnal pattern of flowering is very striking in the Nieuwoudtville area where several species are sympatric. First to bloom is the blue form of *H. pilosa* (06h00–13h00) followed by the dark pink-flowered *H. pauciflora* (12h00–16h30) and nearby, but in a different habitat, *H. vaginata* (15h00–18h00) followed by *H. cucullata* and *H. bachmannii* (16h00–17h00) and then *H. radiata* (about 18h00). All these species excepting the curved-tubed *H. bachmannii* and *H. radiata*, have flowers of essentially identical form and proportion, and differ only in their colour and flowering time. The diurnal replacement of flowering time of one species by another through the day suggests that this mode of speciation may be important in *Hesperantha*, perhaps accounting for the evolution of several species in the genus.

Breeding Systems

In general species of *Hesperantha* can be said to be modally outcrossing,

their relatively large and conspicuous flowers readily attracting insect visitors that accomplish pollination. Several species have been observed in the greenhouse and of these only two, *H. radiata* and *H. pauciflora*, have proved to be strongly self-incompatible.

Several more, including *Hesperantha cucullata*, *H. marlothii*, *H. bachmannii*, *H. erecta*, *H. pilosa*, *H. petitiiana* (a tropical African species) and four populations of *H. falcata*, are what may be termed facultatively self-compatible to autogamous. In these species a number of capsules on a spike (never all) will set seed by their own pollen (either transferred by hand or by normal contact between style branch and anther). These capsules are occasionally as large but usually somewhat smaller than those that develop after cross-pollination. However, they may only contain a much reduced number of seeds (sometimes 1–3 seeds per capsule).

The small-flowered form of *Hesperantha falcata* from the southern Cape as well as three long-tubed and large-flowered species, *H. pallescens*, *H. purpurea* and *H. latifolia*, are evidently autogamous. This is unexpected in *H. pallescens*, *H. purpurea* and *H. latifolia* in view of their large, fairly conspicuous and scented long-tubed flowers.

Vegetative reproduction occurs in a few species to a limited extent by the production of two or more basal cormlets annually. A few species, notably *Hesperantha pallescens* and *H. bachmannii*, however, produce large numbers of tiny basal cormlets around the main corm, and this ability must enhance their reproductive and survival capabilities. In some forms of *H. radiata* several large corms are also regularly produced at the base.

Hybrids

No natural hybrids have been recorded in *Hesperantha* despite the fact that species are frequently sympatric. This may be attributed to breeding barriers between species especially those taxonomically distant (see below) or to differences in pollinators and timing of the opening and closing of the flowers.

In the greenhouse, experimental hybrids can sometimes be produced, but rarely between species in different sections. More often crosses succeed between closely related species within the same section. Of attempts between pairs of species, two out of four intrasectional crosses were successful and only two out of ten intersectional crosses succeeded. In section *Imbricata*, *H. bachmannii* and *H. pallescens* can easily be crossed, while in section *Hesperantha*, *H. falcata* and *H. pauciflora* also cross. In the same section the autogamous *H. latifolia* could not be crossed with either *H. falcata* or *H. pauciflora*.

The only intersectional hybrids obtained were between *H. erecta* x

H. bachmannii and *H. erecta* x *H. pauciflora*. Only one cross between each succeeded and the results require confirmation.

These results are somewhat unusual in subfamily Ixiodeae where more often interspecific crosses can be made with relative ease between all species of a genus and even between some genera (Goldblatt, 1971). The best known example of the ease of crossing species in the subfamily is *Gladiolus* (ca. 150 spp.) while *Freesia* (Goldblatt, 1981) is another good example of a genus in which interspecific crosses can be made between distantly related taxa.

CYTOLOGY

Hesperantha is unusually uniform cytologically. The basic chromosome number is $x = 13$ (Fernandez & Neves, 1961; Goldblatt, 1971), this having been established on the basis of counts for 12 species (one now reduced to synonymy). Original counts for 26 species are presented here (Table 2) of which 16 are first reports for species, making a total of 27 species, a little over half the total in the genus, for which the chromosome number is now known. All but two of the species counted are from the winter rainfall area. Counts for nearly all species, including as many as four or five populations of some, are diploid, $2n = 26$. One exception is *H. purpurea* where triploid as well as diploid individuals were encountered. B chromosomes have been recorded in one species, *H. luticola*, $2n = 26 + 2B$.

The basic number of $x = 13$ is somewhat unusual in Iridaceae, but it is shared by *Geissorhiza* (ca. 70 spp.) and *Schizostylis* (1 or 2 spp.) (Goldblatt, 1971). Both these genera are closely related to *Hesperantha* and all three have a common karyotype, which consists of fairly small meta- to submetacentric chromosomes that range in size from 2.5–4 μm .

CONSERVATION

Most species of *Hesperantha* in the winter rainfall area are in little danger at present as they tend to grow in semi-arid areas or are sufficiently common and widespread. However, a number of the more local endemics comprise few or very small populations and relatively minor local events could severely reduce numbers so that the species may come close to extinction. Species in this category known from only one or few populations and which have been collected recently and are well known are *H. vaginata*, *H. karooica*, *H. hantamensis*, *H. purpurea*, *H. pallescens*, *H. namaquana* and *H. elsiae*. Of these, *H. vaginata*, known from three localities in the Calvinia district, seems reasonably secure but a change in farming practice on the rich red clay soil on which it grows could conceivably rapidly reduce the present large populations to near extinction.

TABLE 2.

Chromosome numbers in *Hesperantha*. Original counts are marked with an asterisk. All localities are in South Africa, and unless otherwise stated, in the Cape Province. Previous counts were reported by Goldblatt (1971).

Species	Diploid Number	Collection Data
<i>H. acuta</i>	26*	Karoo Garden, Worcester, <i>Compton</i> 20743 (NBG)
<i>H. bachmannii</i>	26	Nieuwoudtville, <i>Goldblatt</i> 229 (BOL) (as <i>H. angusta</i>)
	26*	North of Hankey, <i>Goldblatt</i> 4937 (MO); Wildepaardehoek Pass, Namaqualand, <i>Goldblatt</i> 5754 (MO)
<i>H. baurii</i>	26	Graskop, Transvaal, <i>Goldblatt</i> 72 (J)
<i>H. brevifolia</i>	26*	Piketberg, Zebrakop, <i>Esterhuysen</i> 35320 (MO)
<i>H. cedarmontana</i>	26*	Cedarberg, Middelberg Plateau, <i>Goldblatt</i> 5130 (MO); Pakhuis Pass, <i>Goldblatt</i> 6403 (MO)
<i>H. cucullata</i>	26	Nieuwoudtville, <i>Goldblatt</i> 243 (BOL) (as <i>H. buhrii</i>)
	26*	Nieuwoudtville, Glenlyon, <i>Goldblatt</i> 3954 (MO)
<i>H. elsiae</i>	26*	Cedarberg, top of Krom River Kloof, <i>Goldblatt</i> 5331 (MO)
<i>H. erecta</i>	26*	Saldanha distr., Donkergat, Posberg, <i>Goldblatt</i> 4095 (MO)
<i>H. falcata</i>	26	Cape Point Reserve, Cape Peninsula, <i>Goldblatt</i> 149 (J)
	26*	Malmesbury, commonage, <i>Goldblatt</i> s.n. no voucher; Tulbagh falls, <i>Goldblatt</i> 4763 (MO); Near Tulbagh, <i>Goldblatt</i> 4756 (MO); The Rest, Piekens Kloof, <i>Goldblatt</i> 5644 (MO); Caledon distr., Sandys Glen road, Fairfield, <i>Goldblatt</i> 4847 (MO)
<i>H. fibrosa</i>	26*	Caledon distr., Commonage S of town, <i>Goldblatt</i> 6199 (MO)
<i>H. flava</i>	26*	Steinkopf, Namaqualand, <i>Goldblatt</i> 5750 (MO); Ghaap Kop, near Matjiesfontein, <i>Goldblatt</i> 6074 (MO)
<i>H. flexuosa</i>	26	Springbok, <i>Goldblatt</i> 191 (BOL)
	26*	Wildepaardehoek Pass, <i>Goldblatt</i> 5755 (MO)
<i>H. humilis</i>	26*	Worcester distr., near Matroosberg Station, <i>Goldblatt</i> s.n. no voucher; Roggeveld NW of Sutherland at Voëlfontein, <i>Goldblatt</i> 6340 (MO)
<i>H. huttonii</i>	26	Graskop, Transvaal, <i>Goldblatt</i> 73 (J) (as <i>H. longituba</i>)
	26*	Katberg, cliffs along pass, <i>Goldblatt</i> 5455 (MO)
<i>H. latifolia</i>	26*	Kamiesberg, Rooiberg slopes, <i>Goldblatt</i> 5760 (MO)
<i>H. luticola</i>	26* & 2B	Calvinia-Middelpos rd., near Blomfontein, <i>Goldblatt</i> 5814 (MO)

<i>H. montigena</i>	26*	Worcester distr., Mt Brodie, <i>Esterhuysen</i> 35307 (MO); Milner Peak, Hex R. Mts, <i>Esterhuysen</i> 35528 (MO)
<i>H. marlothii</i>	26*	Calvinia-Middelpos rd., near Blomfontein, <i>Goldblatt</i> 5813 (MO); Nieuwoudtville escarpment, <i>Goldblatt</i> 5835A (MO)
<i>H. muirii</i>	26*	Hills W of Riversdale, <i>Goldblatt</i> 5189 (MO)
<i>H. pauciflora</i>	26	Nieuwoudtville, <i>Goldblatt</i> 231 (BOL)
	26*	Kamiesberg, Welkom, <i>Goldblatt s.n.</i> no voucher
<i>H. pallescens</i>	26*	Foot of Piekenierskloof Pass, <i>Goldblatt</i> 5645 (MO)
<i>H. pilosa</i> subsp. <i>pilosa</i>	26	Nieuwoudtville, Grasberg rd., <i>Goldblatt</i> 272 (BOL); Nieuwoudtville, <i>Goldblatt</i> 284 (BOL) (as <i>H. puberula</i>)
	26*	Cedarberg, Middelberg Plateau, <i>Goldblatt</i> 5134 (MO); Calvinia-Middelpos rd., near Blomfontein, <i>Goldblatt</i> 5810 (MO)
<i>H. purpurea</i>	26, 39*	Perdekraal, NW of Calvinia, <i>Goldblatt</i> 6246 (MO)
<i>H. radiata</i>	26	Touws River, <i>Goldblatt</i> 146 (J)
	26*	Malmesbury, commonage, <i>Goldblatt</i> 6283 (MO); North end of Cold Bokkeveld, <i>Goldblatt</i> 5343 (MO)
<i>H. rivulicola</i>	26*	Calvinia, along water courses, <i>Goldblatt</i> 5807 (MO)
<i>H. spicata</i> subsp. <i>graminifolia</i>	26	Darling, <i>Goldblatt</i> 416 (BOL) (as <i>H. spicata</i>)
	26*	Cape Peninsula, slopes N of Cape Pt. Reserve <i>Goldblatt</i> 5263 (MO)
<i>H. vaginata</i>	26	Nieuwoudtville, NW Cape, <i>Goldblatt</i> 259 (BOL); <i>Goldblatt</i> 93 (J) (as <i>H. stanfordiae</i>)
	26*	Perdekraal, NW of Calvinia, <i>Goldblatt</i> 6229 (MO)

Hesperantha pallescens may have a slightly wider range than the present record indicates but its known distribution is limited to a few metres of roadside and wheatfield margin below Piekeniers Kloof Pass. Minor road widening or the extension of the ploughed land would exterminate entirely the only known population.

Two species, *Hesperantha hantamensis* and *H. karooica*, are recorded only from the flats at the foot of the Hantamsberg near Calvinia. This area is partly included in a nature reserve but the species occur in such a restricted area that road widening or extension of the Akkerendam Dam in the reserve could immediately endanger them. Both are very small and inconspicuous so that it is possible that they have a wider range than is recorded and perhaps their future may be more secure than it appears.

The other very localised species mentioned above, *Hesperantha purpurea*, *H. namaquana* and *H. elsiae*, seem secure in spite of their small re-

corded ranges, as they grow in rocky sites in localities distant from human activity.

A special category of species must be mentioned, those known from only a single locality and collection. These include *Hesperantha minima*, *H. oligantha*, *H. ciliolata*, *H. saldanhae* and *H. juncifolia*, none of which has been found recently. Their conservation status is difficult to determine. *Hesperantha saldanhae*, which was collected near Saldanha Bay, may be extinct. Urban and industrial expansion has taken place rapidly here in the last decade and several collecting expeditions to the area have failed to locate the species. The limestone endemic *H. juncifolia* must also be severely threatened, as is much of the flora of the limestone areas of the southern Cape, by the spread of alien shrubs and trees, particularly *Acacia cyclops* and *Leptospermum laevigatum* which are choking the native and highly endemic limestone flora. *Hesperantha minima*, *H. oligantha* and *H. ciliolata* are probably little threatened as they occur in places far from roads or towns but efforts should nevertheless be made to discover more about these species.

The ranges of two fairly widespread species, *Hesperantha fibrosa* and *H. muirii*, have been much reduced in the last forty years by increases in agricultural activity in the southern and south western Cape. However, sufficient populations of the species still occur for them to be considered not actively threatened.

SUBGENERIC CLASSIFICATION

The subgeneric classification followed here was first outlined in 1982 (Goldblatt, 1982b) in a treatment in which corm characteristics were strongly emphasised. This classification distributes the winter rainfall area species of *Hesperantha* among four sections. The least specialised of these is believed to be section *Concentrica*, all species of which have asymmetric corms with concentric corm tunics (Fig. 8 A–E). The species of section *Imbricata* have asymmetric to almost symmetric corms with imbricate tunics, the older layers of which are displaced upwards and notched below (Fig. 8 F–H). Corms in the species of section *Hesperantha* are symmetric, and triangular to campanulate with a broad flat side (Fig. 8 I–L). The species of the specialised section *Radiata* have globose or flat-sided corms with imbricate tunics, and are peculiar in having unusual bracts in which the margins are united below for some distance around the spike axis and flowers which typically have a curved perianth tube (Fig. 30–32).

The largest of the sections is section *Concentrica* with some 25 species of which 11 occur in the winter rainfall area and the Karoo. The section ex-

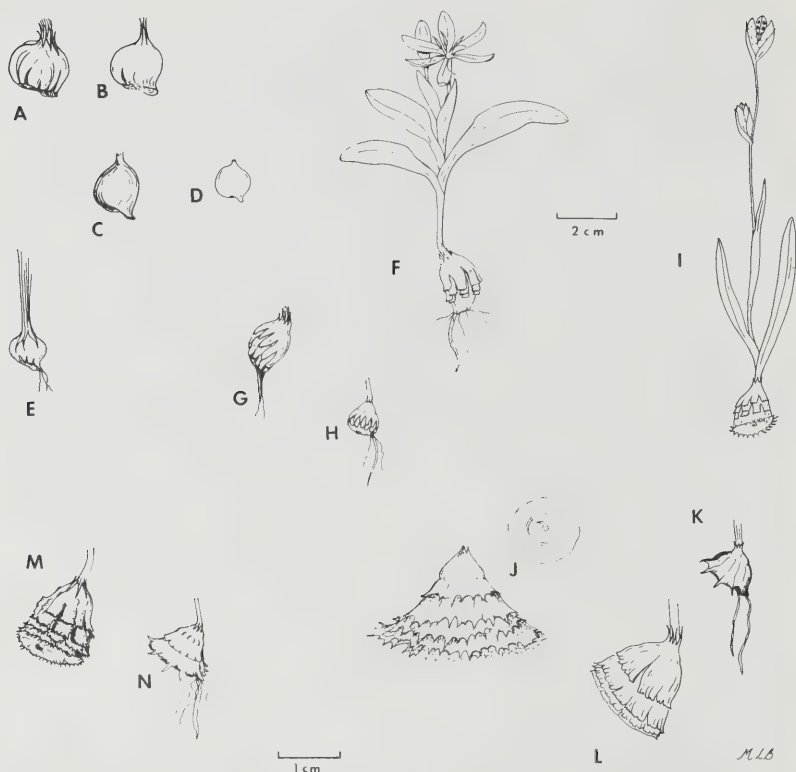


FIG. 8

Corm morphology in *Hesperantha*: A–C: *H. pilosa* with tunic layers progressively removed and D the naked corm; E: *H. fibrosa*; F: *H. humilis*; G: *H. pallescens*; H: *H. bachmannii*; I: *H. cedarmontana*; J: *H. falcata*—naked corm with tunic removed and the intact corm; K: *H. luticola*; L: *H. spicata*; M: *H. radiata*; N: *H. marlothii* (all \pm life-size except F and I, $\times 0,5$).

tends through eastern southern Africa into the mountains of central Africa, Ethiopia and Cameroun. Section *Imbricata* is found mainly in the Karoo and it has radiated extensively in the western Karoo where 10 of the 12 species occur. Only two species of section *Imbricata* extend to any degree outside the winter rainfall area, *H. longituba* (eastern Karoo) and *H. bulbifera* (Boschberg to the Transvaal). Section *Radiata*, comprising only seven to

nine species, occurs throughout southern Africa, but only *H. radiata* as well as *H. longicollis* and *H. ballii* occur outside the winter rainfall area, the latter two endemic to eastern southern Africa. Section *Hesperantha*, comprising seven species, is entirely restricted to the winter rainfall area and extends from northern Namaqualand to Port Elizabeth.

Formal descriptions of the sections as well as a brief discussion of the variation encountered in each section are presented in the taxonomic treatment.

MORPHOLOGY

Rootstock

The rootstock is a corm with distinctive hard woody (rarely brittle-papery) tunics. The morphology of the corm and the corm tunics have been described in detail in an earlier paper (Goldblatt, 1982b) but is recounted briefly here. The live portion of the corm is a small white structure consisting of a single swollen internode, with a minute apical bud (Fig. 8 D, J). It is always asymmetric, being somewhat flattened on one side or towards the base, and it has a peculiar down-pointing projection at the lower end of the flattened side. This projection is the point from which the roots are produced.

Tunic morphology is variable in *Hesperantha* (Goldblatt, 1982b) and, as an important taxonomic character in *Hesperantha*, the tunics are an invaluable guide to natural relationships. Shape of the tunics reflects to some extent that of the internal corm but often the presence of the lateral projection is not indicated by any external feature.

There are two distinct tunic types, concentric and imbricate (in the terminology of Foster, 1941; 1948). In the concentric type, the corms are usually small, of constant size, and the old tunic layers split from base and apex into somewhat elliptic sections which completely enclose the new tunic layers produced in successive years. In corms of this type, characteristic of section *Concentrica* and here represented by *H. pilosa* (Fig. 8 A-D), one side is obliquely flattened below and the lower end is produced into a down-pointing projection from which the roots emerge, and is thus essentially asymmetric. *Hesperantha fibrosa* stands out in this section in having the tunics drawn into long fibres above (Fig. 8 E).

In corms with imbricate tunics (Fig. 8 F-N) the older layers are split in the lower part and displaced upwards. As successive layers accumulate above, the tunics overlap one another in a distinctive way. The upward displacement of the older tunics is usually easy to determine, but occasionally the displacement is minimal and then the tunic type is difficult to recognise.

Imbricate corm tunics are found in the remaining sections of the genus.

Typical examples of species with imbricate tunics are *H. humilis* and *H. pallescens* (both section *Imbricata*) (Fig. 8 F, G) in which the corm is more or less globose with one side flattened below. The smaller corm of *H. bachmannii* (Fig. 8 H), also section *Imbricata*, is virtually symmetric externally but has similar overlapping tunic layers. In section *Hesperantha* the corms are symmetric, and campanulate to triangular in outline with a broad flat side, e.g. *H. falcata* and *H. cedarmontana* (Fig. 8 J, K). The flat side is actually not basal in the ground, but oblique or even vertical. In some forms of *H. falcata* and several other species of the section, spines are produced from the lower margins of the tunic, e.g. *H. luticola* (Fig. 8 K). In *H. spicata* and *H. saldanhae* the lower margins are entire or lightly frayed.

Such apparently symmetric corms are also found in some species of section *Radiata* in which there are two corm types. In many forms of *H. radiata* (Fig. 8 M) and in *H. muirii*, *H. elsiae*, *H. brevifolia* and *H. juncifolia* the lower margins are incised below into more or less rectangular segments, and each segment has slightly fringed edges that curve outwards, making the tunics appear to be composed of concave sections. The very characteristic development is strangely not found in all populations of *H. radiata*. In other forms the corms are campanulate with the lower margins of the tunics unevenly toothed, while in *H. marlothii* (Fig. 8 N), the lower part of the tunic layers are produced into long spines.

Leaves

Cataphyll: there is usually a single transparent and membranous cataphyll sheathing the stem base below ground, but this is often lacking or fragmentary in dry material. The cataphyll of *Hesperantha quadrangula* stands out as being rather robust and conspicuously yellowish-brown, and it is a good marker for this otherwise rather undistinguished species.

Produced leaves: these are defined as having a free, unifacial apex as opposed to stem bracts which are entirely sheathing. There may be from 3 (rarely 2) to several produced leaves and in most species the number is quite constant. The primitive state is presumed to be several as in *H. cucullata*, *H. falcata*, *H. semipatula*, species of section *Radiata* and several others, and the number is variable in these species.

The number is fixed in a large number of species and the usual pattern is two large basal leaves, and a third subbasal or cauline and partly sheathing leaf. This latter is often conspicuous, being larger, and sheathing for much of its length (e.g. *H. quadrangula*, *H. flexuosa*, *H. pilosa*) and is sometimes inflated and spathe-like. Species with consistently three leaves without a bract leaf are *H. fibrosa*, *H. flexuosa*, *H. quadrangula* and *H. rivulicola*, but

three leaves also occur in depauperate specimens of other species, notably *H. falcata*. Leaf shape is typically ensiform to linear, acute and erect or erect-falcate. The leaves of *H. quadrangula* are unusual in being oblong and obtuse. In *H. humilis*, *H. flava* and *H. hantamensis*, the leaves are falcate and obtuse, and generally distinctive. Texture is unusually thin in *H. bachmannii* and *H. pallescens*, but leaves of most other species are normally firm but not notably ribbed. An exception is *H. ciliolata* which has multi-ribbed leaves, and the narrow intervening grooves are covered by dense, microscopic cilia. The leaves of *H. pilosa* are pilose.

Bract leaves: these range from green and leaf-like, but entirely sheathing, to membranous and are sometimes reduced to scales. The presence of a bract leaf is usually constant in a species and is a notable feature of *H. spicata*, *H. acuta*, etc. In *H. pilosa* subsp. *latifolia* the bract leaves are pilose, and sometimes very short to membranous, while in *H. pilosa* subsp. *pilosa* and the presumably allied *H. ciliata*, this bract is reduced and usually a membranous structure, often only 1–3 mm long.

Stem

The stem is typically erect, smooth, terete and produced well above the ground. It is however, partly to entirely subterranean in *Hesperantha humilis*, *H. flava* and *H. hantamensis* (section *Imbricata*) in *H. laticola* and usually so in *H. latifolia* (both section *Hesperantha*). To compensate for the lack of stem, these species all have an unusually long perianth tube.

The stem is usually sheathed below by leaf bases, and in many species the third leaf is specialised as a sheath which envelopes the lower half of the stem. The upper half of the stem may be naked, or bear a specialised bract leaf (see previous section). The stem is usually, but not invariably pilose in *H. pilosa*. Branching is very variable, but certain species such as *H. pilosa*, *H. quadrangula*, *H. spicata*, *H. elsiae* and all species of section *Radiata* produce branches only rarely.

Inflorescence

This is a spike of several (rarely one) flowers and may be more or less straight to markedly flexuose. The number of blooms is variable depending on age and health of the plants and seasonal and soil conditions. The acaulent species typically have fewest flowered spikes.

The floral bracts are paired, the outer and larger enclosing an opposed inner, narrower and usually shorter one. The inner bract has been used very little as a taxonomic character. It is a double structure with two main veins and a forked apex.

The outer bracts are herbaceous, and firm in texture, but often become dry from the apex soon after blooming. In section *Radiata* the outer bracts have margins partly united round the stems (or inner bracts in the case of the terminal flower). In *Hesperantha radiata* the margins may be joined for as much as two-thirds of their length, imparting a very characteristic appearance to the spike. There is little to distinguish the bracts of other species with the exception of the acaulescent group of *H. humilis*, *H. flava* and *H. hantamensis*, where the outer bracts are larger than usual, firm-textured and keeled, and much longer than the quite membranous inner bracts.

Flower

Most species of *Hesperantha* have very similar actinomorphic flowers with a well-developed, straight, slender cylindric perianth tube and horizontally extended tepals. The tube is generally about as long as the bracts which surround the tube, but after fertilisation the tube becomes exserted a few millimetres from the bracts due to the rapid enlargement of the ovary.

Longer and typically exserted perianth tubes are characteristic of all acaulescent species, and of some other winter rainfall area species such as *Hesperantha elsiae*, *H. cedarmontana*, *H. namaquana*, *H. longituba*, *H. pallescens*, *H. purpurea* and *H. oligantha*. Curved tubes are found in *H. bachmannii*, *H. bulbifera* (section *Imbricata*) and in most species of section *Radiata*, but particularly in *H. radiata* and *H. marlothii*, in which the flowers face downwards.

In the majority of species of the winter rainfall area flower colour is white or cream with some red to brown colouration on the reverse of the outer tepals. Such flowers are usually evening blooming, opening at times specific for a population or species, between 16h00–19h00, and closing at various times before daybreak. A strong scent is released on opening. These flowers are presumed to be moth-pollinated.

Some species in each section have highly coloured flowers (Figs 1, 4, 6) and these usually open during the day and close before nightfall. Day-blooming species are *Hesperantha vaginata* (flowers yellow usually with contrasting black markings), *H. humilis* (pink to red), *H. purpurea* (red-purple), *H. pallescens* (pale yellow), *H. elsiae* (pink), *H. pauciflora* and *H. latifolia* (both pink to reddish-purple). Presumably *H. karooica* (yellow flowers) and *H. oligantha* (purple flowers) are also day blooming but I have not seen these species alive and the information is not recorded. *Hesperantha flava* is exceptional in having bright yellow flowers and being night blooming.

In two species with typically white and night-blooming flowers, *Hesperantha falcata* and *H. pilosa*, there are populations with coloured and day-

blooming flowers. Coloured flowers forms are yellow to cream in *H. falcata*, and blue to purple in *H. pilosa*. In both species evidence suggests that coloured flowers have evolved independently in several isolated populations. Some of these populations have been described as distinct species or varieties (e.g. *H. lutea*, *H. puberula*, *H. bracteolata*), but have no correlated morphological characters that distinguish them apart from flower colour, and none of these colour forms is given taxonomic recognition in this treatment.

Stamens

The three stamens typically have well-developed filaments inserted on the perianth at the apex of the tube. In *Hesperantha saldanhae* the filaments are unusually short, ca. 1 mm long, and the anthers appear sessile. In *H. elsiae* (section *Radiata*) and *H. cedarmontana* (section *Hesperantha*) the filaments are inserted well within the perianth tube and are relatively short. The large-flowered *H. purpurea* is also unusual in having disproportionately short filaments ca. 2 mm long.

The anthers are usually somewhat longer than the filaments, and erect to ascending, or articulated at the filament apex and then horizontal (e.g. *H. cucullata*, *H. humilis*). In *H. elsiae* and *H. cedarmontana* the anthers are included in the perianth tube but in the latter the anther apices reach the mouth of the tube. Anther size is generally a good taxonomic character as it is fairly constant in a species, and easy to measure.

Gynoecium

Style: typically the style is filiform, and divides at the apex of the perianth tube, to form three, long and diverging branches that spread horizontally. Although this character is one which defines the genus, there is some variation. In species with flowers facing to the side or towards the ground, the style branches are pendent, and tend to become unilateral. This is especially noticeable in *H. radiata*, *H. bachmannii*, *H. juncifolia* and the large-flowered *H. muiirii*. More unusual are *H. cedarmontana*, *H. saldanhae* and *H. elsiae*, in which the style divides well within the perianth tube. The branches are partly emergent in *H. saldanhae* and *H. cedarmontana*, but entirely included in *H. elsiae*.

Ovary: the oblong to ovoid ovary has little taxonomic value, and apart from size there is little to distinguish species on this character.

Fruit

The fruit is a thin-walled loculicidal capsule, more or less ovoid-oblong in shape. The ovary develops rapidly after fertilization, and generally grows

to reach the apex of the bracts before maturing. The bracts enclose to some extent the young fruits but in the later stages of development the bracts become dry and broken.

Among the winter rainfall area species, *Hesperantha radiata* and *H. muirii* (section *Radiata*) stand out as having particularly long slender capsules and these remain within the bracts throughout development. The capsules dehisce only near the apex due to the constraining effects of the sheathing bracts and thus may be regarded as poricidal.

Seeds are basically turbinate to globose in shape with a persistent funicle and a testa of uncontorted epidermal cells with smooth surfaces. Deviations from this basic type include increasing compression, resulting in a more or less angular to irregular shape and the wrinkling and crumpling of the epidermal cells (Wagner & Goldblatt, in prep). In the most derived type of seed, the edges develop angular wing-like structures and tails at the opposite ends. This development is most marked in section *Radiata* (but not *H. marlothii* of this section), where it is accompanied by a reduction in the size of the seeds. Similar angular and winged seeds are also found in sections *Hesperantha* (*H. spicata* and *H. cedar montana*) and *Concentrica* (*H. fibrosa*) but in both these groups without the accompanying crumpling of the epidermal cells. In both these groups, however, the epidermal cells have distinctive roughened surfaces. Although the seeds of all the species are not yet known, and seed structure is relatively uniform, seed morphology is of some taxonomic value. It has confirmed the unity of section *Radiata* and provides support for regarding this section as the most specialised and derived in *Hesperantha*.

TAXONOMIC TREATMENT

Hesperantha Ker, König & Sims, Ann. Bot. 1: 224. 1805; Baker, Flora Cap. 6: 57. 1896; Foster, Contr. Gray Herb. 156: 3–27. 1948.

Ixia L. sensu L.f., Suppl. Pl. 92. 1781 et Thunb., Diss. de *Ixia* 156–193. 1783. pro parte.

Plants small to medium in size. *Corm* small, asymmetric to apparently symmetric, either ovoid-globose, with or without an oblique flattened side, occasionally with down-pointing projection, or campanulate-triangular in outline (section *Hesperantha*) with a flat base, tunics hard, woody, rarely firm-membranous, either concentric, and usually light to dark brown, with outer layers completely covering inner and splitting into vertical, often elliptic sections tapering to points above and below (section *Concentrica*), or imbricate and dark to blackish, with outer layers covering inner above only,

sometimes notched below into segments or margins more or less unbroken and sometimes serrate or toothed. *Cataphyll* usually single, membranous, reaching to ground level, pale-transparent (dark yellow-brown in *H. quadrangula*). *Foliage leaves* 3—several, lower basal, upper sometimes cauline, one often sheathing lower part of stem for most or rarely all its length and seemingly spathe-like (cauline sheath); cauline leaves usually shorter, becoming bract-like; leaves linear-lanceolate, rarely terete, erect or falcate, margins plane, occasionally midrib raised, or margins and midrib thickened, lamina smooth, or ribbed and minutely ciliate (*H. ciliolata*) or pilose (*H. pilosa*). *Stem* erect, usually produced above ground, or occasionally entirely below ground, terete, simple or branched, naked above base or bearing leaves below, and sheathing bracts above, smooth or pilose (*H. pilosa*). *Inflorescence* a spike, several to few-flowered, occasionally solitary flowered; *bracts* herbaceous, or membranous if concealed by leaves or leaf bases, inner bracts small, membranous, forked at apex, outer bracts with margins partly united in section *Radiata*. *Flowers* usually stellate, hypocrateriform, frequently white or pale, occasionally red, purple, blue or yellow, actinomorphic, rarely subzygomorphic, with anthers unilateral, often opening at sunset and closing at dawn, tepals subequal or inner whorl smaller, united in a tube; *tube* cylindrical, short, or fairly long, occasionally infundibuliform, either straight, or curved with flower facing downwards. *Stamens* with well-developed filaments inserted in throat of perianth tube, rarely filaments very short and within tube (*H. cedarmontana*, *H. saldanhae*, *H. elsiae*); anthers erect or often articulated and horizontal when flower fully open, usually well exerted from tube, rarely included (*H. cedarmontana*, *H. elsiae*), anthers pendulous in species with strongly curved perianth tubes. *Styles* slender, usually dividing at apex of perianth tube, with three very long spreading branches, rarely dividing within the tube and branches just emerging (*H. saldanhae*) or included (*H. cedarmontana*, *H. elsiae*). *Capsules* ovoid to cylindric, partly to entirely included in bracts during development, dehiscent fully, or only in upper half in *H. radiata*; *seeds* spherical to angled, many per loculus, small (0,3 mm in diameter) to large (2 mm in diameter). *Basic chromosome number* $x = 13$.

Type species: H. falcata (L.f.) Ker.

About 55 species, distributed from Ethiopia southwards along the eastern African mountain belt to the south western Cape and Namaqualand, with an outlier on Cameroun Mountain; concentrated in the western Cape and adjacent Karoo, with a secondary centre in the Drakensberg in eastern southern Africa.

KEY TO *HESPERANTHA*

1. Anthers included in perianth tube
 2. Flowers pink, horizontal 36. *H. elsiae*
 - 2'. Flowers white, upright 25. *H. cedarmontana*
- 1'. Anthers fully exerted from perianth tube
 3. Perianth tube distinctly curved, and flowers facing to the side or towards the ground
 4. Floral bracts with margins fused around the stem for at least 2 mm and up to two-thirds their length
 5. Bracts more than 18 mm long; anthers 6–10 mm long and spike 1–3-flowered 34. *H. muirii*
 - 5'. Bracts 10–18(–20) mm long; anthers 4–7(–8) mm and spike (1–)3–15-flowered
 6. Bract united round stem for \pm half its length; spike (1–)6–15-flowered 32. *H. radiata*
 - 6'. Bract united round stem (or inner bract) for no more than one-third its length; spike 1–5-flowered 33. *H. marlothii*
 - 4'. Floral bracts with margins free, or if united round stem then for less than 1 mm
 7. Perianth tube reaching at least to apex of bracts
 8. Perianth tube 6–8 mm long; corm small, to 5 mm in diameter and lacking radiate spikes on lower margin 31. *H. brevifolia*
 - 8'. Perianth tube 10–12 mm long; corm 8–13 mm in diameter, bearing radiate spines on lower margin 33. *H. marlothii*
 - 7'. Perianth tube usually shorter than bracts, or if longer, still emerging below apex of bracts
 9. Plants bearing a cormlet in axil of one to several stem nodes 23. *H. bulbifera*
 - 9'. Plants without axillary cormlets 22. *H. bachmannii*
 - 3'. Perianth tube straight, erect or diverging from stem
 10. Leaf pilose to microscopically ciliate
 11. Leaf and often stem pilose 5. *H. pilosa*
 - 11'. Leaf microscopically ciliate, stem smooth 6. *H. ciliolata*
 - 10'. Leaf smooth
 12. Margins of outer bract united below for at least one-third their length; leaves terete 35. *H. juncifolia*
 - 12'. Margins of outer bract not united below for any distance; leaves not terete
 13. Corm small, less than 5,5 mm in diameter and ridged vertically 31. *H. brevifolia*
 - 13'. Corm more than 5 mm in diameter or not ridged vertically
14. Corm \pm symmetric and campanulate to triangular in outline with a broad flat base, and sometimes with teeth radiating from lower margin
 15. Perianth tube 15–45 mm long
 16. Flower white with dark markings at base of tepals; anthers 3–5 mm long 28. *H. luticola*
 - 16'. Flower uniformly purple (deep pink); anthers (4–)5,5–7 mm long 27. *H. latifolia*
 - 15'. Perianth tube less than 15 mm long
 17. Style dividing at apex of perianth tube and branches spreading
 18. Perianth tube 4–6 mm long; tepals 4–8 mm long ... 29. *H. spicata*

- 18'. Perianth tube 5–11 mm; tepals (9–)12–26 mm long
 - 19. Flower white, cream or yellow 24. *H. falcata*
 - 19'. Flower uniform pink (-red) or purple 26. *H. pauciflora*
- 17'. Style dividing well within perianth tube and branches included, or apices only emerging 30. *H. saldanhae*
- 14'. Corm globose, usually asymmetric with one side flattened and often extended downwards
 - 20. Stem very short, usually hidden by leaf bases, or entirely underground; bracts large, herbaceous, (15–)20–30 mm long
 - 21. Flower small, white, with tepals 8–12 mm long 18. *H. hantamensis*
 - 21'. Flower pink, red or yellow; tepals 13–24 mm long
 - 22. Basal leaves 2(–3); flower pink or red with tepals 17–25 mm long 16. *H. humilis*
 - 22'. Basal leaves 2(–3); flower yellow, with tepals 13–15 mm long .. 17. *H. flava*
 - 20'. Stem well developed, sometimes covered by a sheathing leaf below; bracts herbaceous to membranous 3–20(–22) mm long
 - 23. Perianth tube 2–9(–11) mm long
 - 24. Flower very small, tepals 5–6 mm long 10. *H. minima*
 - 24'. Flower larger, tepals 9–35 mm
 - 25. Flower very large, tepals 28–35 mm long 14. *H. vaginata*
 - 25. Flower smaller, tepals 9–22 mm long
- 26. Flower white to yellow (often red to brown on reverse of outer tepals)
 - 27. Flower yellow
 - 28. Tepals ca. 20 mm long, anthers to 9 mm 15. *H. karooica*
 - 28'. Tepals 10–17 mm long; anthers to 7 mm 3. *H. acuta*
 - 27'. Flower white
 - 29. Perianth tube very short, 2–3 mm long; cataphyll conspicuous and brownish to yellow 8. *H. quadrangula*
 - 29'. Perianth tube 5–11 mm long; cataphyll seldom conspicuous, often lacking, pale and membranous, rarely brown
- 30. Corm (7–)9–14 mm in diameter; tunics imbricate; tepals 15–20 mm long 13. *H. cucullata*
- 30'. Corm 3–10 mm in diameter; tunics concentric; tepals 9–15(–17) mm long
 - 31. Leaves 3 only, narrow 0.5–1.5(–2) mm wide and corm 3–6 mm in diameter 9. *H. flexuosa*
 - 31'. Leaves 3–4, linear to ensiform (1–)2–5 mm wide; corm (6–)7–10 mm in diameter
 - 32. Plants with a distinct bract leaf in upper half of stem 3. *H. acuta*
 - 32'. Plants without sheathing bracts
 - 33. Leaves linear, slightly inflated; plants of wet sites in the Calvinia district 7. *H. rivulicola*
 - 33'. Leaves linear to ensiform, skin textured and flat; plants of the West Coast from Mamre to Klawer 1. *H. erecta*
- 26'. Flower pink to purple 11. *H. fibrosa*
 - 23'. Perianth tube 12–35 mm long
 - 34. Flower pure white within, often red, pink or brownish on reverse of outer tepals
 - 35. Anther 8–12 mm long; corm 10–20 mm in diameter 12. *H. longituba*
 - 35'. Anther 5–7 mm long; corm 3–8(–9) mm in diameter
 - 36. Corm 3–5(–6) mm in diameter, narrowly ovate; tunics soft-textured 4. *H. montigena*

- 36'. Corm 6–9 mm in diameter, ovoid to globose; tunics woody
- 37. Plants typically with a sheathing bract leaf in upper part of stem; perianth tube 8–11(–17) mm long 3. *H. acuta*
- 37'. Plants without a sheathing bract in upper part of stem; perianth tube 13–17 mm long 2. *H. namaquana*
- 34'. Flower pale to deep yellow or shades of red to purple
- 38. Filaments very short, less than 2 mm long and flower reddish-purple 19. *H. purpurea*
- 38'. Filaments longer, 2–5 mm long and flower yellow, or 8–10 mm and flower purple
- 39. Flower purple; filaments 8–10 mm long 20. *H. oligantha*
- 39'. Flower yellow; filaments 2–5 mm long
- 40. Tepals cupped when fully open; corm \pm symmetric with imbricate tunics. 21. *H. pallescens*
- 40'. Tepals extended horizontally when fully open; corm asymmetric with one side flattened below, and tunics concentric 3. *H. acuta*

Section CONCENTRICA

1. Section **Concentrica** Goldbl., Ann. Missouri Bot. Gard. **69**: 375–376. 1982.

Corm \pm symmetric to asymmetric, with one side flattened below, the flat side often extending downwards for some distance, tunics concentric, outer layers completely enclosing inner, fragmenting irregularly into unequal sections, often drawn into points above, usually brittle and woody but sometimes soft and papery. *Flower* actinomorphic, rarely zygomorphic, whitish, blue, pink or purple, occasionally yellow, often small, tube well exerted from bracts in a few species. *Leaves* pilose in *H. pilosa* or ciliate in *H. ciliolata*, margins thickened in *H. fibrosa* and occasionally in *H. pilosa* and other species.

Distribution: widespread, south western Cape to Ethiopia and Cameroun.

Species: ca. 25, 11 in the winter rainfall area.

Type species: *H. pilosa* (Thunb.) Ker

Section *Concentrica* is the largest and most widespread section, ranging from the south western Cape to Ethiopia and Cameroun. It has radiated extensively in the southern African Drakensberg, as well as in the south western Cape and western Karoo where some 11 species occur. An evolutionary trend is evident in the reduction in number of leaves to three, one of which partly sheaths the stem. A specialised and sometimes membranous and scale-like bract leaf is present on the stems of several species. The widespread *Hesperantha pilosa* is the only pubescent species in the genus, and the local Roggeveld endemic, *H. ciliolata*, the only one with ciliate leaves.

Unusual corm tunics occur in *H. fibrosa* in which the upper part of the tunic is drawn into very long, persistent fibres. In *H. montigena* of the south western Cape mountains, the tunics are soft and papery in texture, a condition also found in several Drakensberg species and in the tropical African *H. petitiana*. There is little floral variation in the winter rainfall area species of this section, small to moderate sized white flowers being the rule. *Hesperantha pilosa* is unusual in having populations with white, blue or purple flowers, while *H. acuta* may have either white or yellow flowers. The rare, south Namaqualand endemic, *H. namaquana*, has flowers with a longer tube than is usual for the section in the winter rainfall area.

1. ***Hesperantha erecta*** (Baker) Benth. ex Baker, Handbk. Irid. 150: 1892 et Flora Cap. 6: 61. 1896; Foster, Contr. Gray Herb. 166: 10. 1948. [comb. attrib. by Baker to Benth., Gen. Plant 3: 703. 1882 is invalid, as basionym not indicated (Foster, 1948: 11)].

Geissorhiza erecta Baker, J. Bot. new ser. 14: 238. 1876. Type: S. Africa, Cape, N side of Olifants R., Drège 8468 (K, lectotype effectively designated by Foster (1948: 10); G, K, L, P, isolectotypes).

Hesperantha semipatula Foster, Contr. Gray Herb. 166: 24. 1948. Type: S. Africa, Cape, Vogelfontein (near Graafwater), Clanwilliam distr., Schlechter 8521 (K, holotype; B, BOL, GRA, K, L, MO, PH, PRE, S, US, Z, isotypes).

Plants (60–)120–220 mm high. *Corm* ovoid, 6–8 mm in diameter, asymmetric, with an oblique flat side, tunics concentric, dark brown, woody, outer layers fragmenting into elliptic segments, tapering at base and apex. *Cataphyll* membranous, or evidently lacking. *Leaves* usually 3(–5), linear-ensiform (1.5–)5–8 mm wide, lower 2–3 basal, upper inserted in lower part of stem, and partly sheathing. *Stem* erect, usually branching. *Spike* flexuose, (1–)3–6-flowered; *bracts* herbaceous, 8–15 mm long, inner usually slightly shorter than outer. *Flowers* infundibuliform, cream (–pale yellow) sometimes with outer tepals darker on reverse, opening about midday and closing 15h00–16h30; *perianth tube* 8–10(–11) mm long, about as long as the bracts, included or slightly exserted, *tepals* 10–15 mm long, narrowly ovoid. *Filaments* ca. 5 mm long; *anthers* (4–)5–6 mm long. *Ovary* ca. 3 mm, style branches slightly shorter than stamens. *Capsule* obovoid, 6–9 mm long. *Chromosome number* $2n = 26$ (Goldblatt 4095).

Flowering time: August–September; flowers opening about midday and closing 15h00–16h30.

Distribution: western Cape coast, recorded from Mamre in the south to the Olifants River, especially common in the Saldanha area, usually on granite outcrops. Fig. 9.

The type locality of *Hesperantha erecta*, Drège 8468, is somewhere along the north bank of the lower Olifants River between about Klawer and present-day Ebenezer (Meyer, 1843: 97 and map). Corms are lacking in all the type collections of *H. erecta* excepting a sheet at Leiden and a fragment on one of the two sheets at Kew. The available corm material is sufficient to determine that the corm is globose, and has concentric tunics. No further records of the species have been made from the area, but collections from the west coastal belt to the south seem to be conspecific. These include Hall 3746 from Kliphoek farm near Vredendal and Schlechter 8521 from Vogelfontein near Graafwater, the type collection of *H. semipatula*. These collections comprise plants with a globose corm having concentric tunics like that of *H. erecta*, but are more variable in both height (60–150 mm) and leaf width (1.5–6 mm wide) compared with the type material of *H. erecta* (180–220 mm high; leaves 2–3 mm wide). It seems reasonable to treat these populations as representing a single species.

The Vogelfontein and Kliphoek collections, especially the sheet of the former at Geneva, have a strong resemblance to a series of populations of a robust, white-flowered *Hesperantha* that occurs along the coast from Veld-drif south to Vredenburg and the Donkergat Peninsula, always on granite outcrops. Plants of these populations differ from the type of *H. erecta* mainly in their broader leaves (to 8 mm wide) of which there may be up to five. With the inclusion of these populations in *H. erecta*, this species emerges as a fairly wide-ranging species of the Cape west coast, especially common in the Saldanha Bay area, where it grows on granite but not on the quartzitic sands also common in this area. It is regarded here as one of the most unspecialised species of *Hesperantha* found in the winter rainfall area. It is clearly a member of section *Concentrica*, but can be distinguished only negatively, by its lack of any notable characteristics, except perhaps its typically narrow, ovoid-lanceolate and acute tepals, which when fully open are slightly cupped, rather than held horizontally as in most species of *Hesperantha*.

Hesperantha erecta is unusual in that while it is self-incompatible, empty inflated fruits develop in flowers that have been selfed, or not pollinated at all. The self-incompatibility system is leaky to the extent that selfed flowers often yield 2 or 3 seeds, a small proportion of the potential seed production.

A collection from Kleinkobbis in the Bokkeveld Mountains, Schlechter 10987, is tentatively assigned to *H. erecta*. Specimens have larger corms with heavier tunics than usual for the species and have broadly ovoid tepals.

SOUTH AFRICA, CAPE—3118 (Vanrhynsdorp): North side of Olifants R. (-CA, -CB or -DA), Drège 8468 (G, K, P); Kliphoek farm, rocky outcrops (-CD), Hall 3746 (NBG); Kleinkobbis (probably -DB), Schlechter 10987 (B, GRA, K, Z).

—3217 (Vredenburg): Rooiheuvel farm, Vredenburg-Stompneusbaai (-DD), *NBG Expedition*, 1969 (NBG 97431); Granite rocks, Vredenburg, *Lewis* 5980 (NBG); Witteklip, Vredenburg, *Lewis* 1046 (SAM).

—3218 (Clanwilliam): Vogelfontein (near Graafwater) (-BA), *Schlechter* 8521 (B, BOL, GRA, K, L, MO, PH, PRE, S, US, Z); 10 miles E of Velddrif, Aurora road (-CB), *Barker* 10411 (NBG).

—3317 (Saldanha): Danger Bay, sandy flats near granite rocks (-BB), *Lewis* 5985 (NBG, STE).

—3318 (Cape Town): Postberg, Donkergat Peninsula (-AA), *Goldblatt* 4085 (K, MO); Mud River road, W of the old Mamre-Darling road (-AD), *Goldblatt* 6287 (MO, NBG).

2. *Hesperantha namaquana* Goldbl., sp. nov.

Plantae 80–120 mm altae, cormo ad 9 mm in diametro, asymmetrico, tunicis concentricis, *foliis* 3(–4), inferioribus basalibus, 3–9 mm latis, *spicis* 2–5 floribus, *bracteis* (12–)15–22 mm longis, floribus hypocrateriformibus, albis vel bubalinis, rubris dorso tepalis exterioribus, *tubo perianthii* 13–17 mm longo, *tepalis* 12–17 mm longis, *filamentis* ca. 3 mm longis, *antheris* ca. 6 mm longis.

Type: S. Africa, Cape, Kareebergen 1 500 ft., *Schlechter* 8304/5 (K, holotype; B, BOL, PRE, isotypes).

Plants 80–120 mm high. *Corm* ovoid, to 9 mm in diameter, asymmetric with each side flattened below, extending downwards with a conspicuous projection, tunics brown, layers evidently concentric. *Cataphyll* membranous. *Leaves* 3(–4), lower 2 basal, falcate, (30–)60–120 mm long, to 3–9 mm wide, upper 1 (or 2) inserted towards base or lower part of stem, and sheathing stem for two-thirds its length, apices free. *Stems* erect, simple or 1-branched, sheathed by leaf bases for most of its length. *Spike* 2–5-flowered; bracts (12–)15–22 mm long, inner \pm equal or shorter, partly membranous. *Flower* probably hypocrateriform, white or pink, dark red on reverse of outer tepals; *perianth tube* 13–17 mm long, slender, exerted from bracts; *tepals* 12–17 mm long, ?obovate. *Filaments* ca. 3 mm long; *anthers* ca. 6 mm long. *Ovary* ca. 3 mm long, style branches 8–10 mm long. *Capsule* 10–15 mm long, about as long as bracts. *Chromosome number* unknown.

Flowering time: late July–mid-August.

Distribution: southern Namaqualand in the shale hills east of Bitterfontein and Nuwerus. Fig. 9.

Hesperantha namaquana is a poorly-known species of southern Namaqualand. As far as is known, it was first collected by Rudolf Schlechter in 1896 either in the Kareebergen, a low range of hills east of Bitterfontein and Nuwerus, or on the farm Kareebergen in this same area. Schlechter's collec-

tion is composed of plants at the end of their flowering season, and most sheets are now in poor condition. The specimens in BOL and K are, however, adequate to form the basis for the description. The tickets on the type collection bear two numbers, 8305 on printed labels on which "Kareeberg" has been hand-stamped, and 8304 on larger, more elaborate labels on which Kareeberg is handwritten. The specimens at B have both labels on the same sheets.

Only one other collection is known, a recent gathering by Nordenstam & Lundgren, 1443, collected in 1974, and unfortunately also late in its flowering period. These plants, from the same general area, are more robust than the Schlechter gathering, and have broader leaves and branched stems. They resemble the Schlechter material closely, having the same long bracts, flowers with a long, exerted perianth tube, and asymmetric corms with concentric tunics and are almost certainly the same species, merely more robust due to favourable growing conditions.

Hesperantha namaquana is probably allied to *H. semipatula*, which occurs to the south, mainly along the west coast on granitic outcrops. *Hesperantha semipatula* has smaller corms with a less-pronounced downward projection, small flowers with short perianth tubes, and shorter bracts.

SOUTH AFRICA, CAPE—3018 (Kamiesberg): 10 km NE of Bitterfontein (-CD) Nordenstam & Lundgren 1443 (MO, S).
—3118 (Van Rhynsdorp): "Kareeberg" (ca. 14 miles SE of Bitterfontein) (-AB), Schlechter 8304/5 (B, BOL, K, PRE).

3. *Hesperantha acuta* (Licht. ex Roem. & Schult.) Ker, Irid. Gen. 91. 1827; Foster, Contr. Gray Herb. 166: 3. 1948. Fig. 9.

Ixia acuta Licht. ex Roem. & Schult., Syst. Veg. 1: 383. 1817; Type: S. Africa, Cape, foot of the Roggeveld Mts., Lichtenstein 453 (B, holotype).

Hesperantha discolor N.E.Br., Kew Bull. 1931: 451; Foster, Contr. Gray Herb. 166: 9–10. 1948; Baker, Flora Cap. 6: 64. 1896. in synonym. sub *H. longituba* Baker. Type: S. Africa, Cape, Worcester, Osplaats-Tunnel Sidings, Rogers 16740 (K, holotype and isotypes).

Hesperantha tugwelliae Foster, Contr. Gray Herb. 166: 26. 1948. Type: S. Africa, Cape, Prince Albert, Tugwell s.n. (National Botanic Gardens 1151/29) (K, holotype; BOL, isotypes).

Geissorhiza caulina Schltr. ms. (Marloth 9728).

Plants 100–200(–350) mm high. Corm narrowly ovoid to globose, generally widest in midline, and to 8 mm in diameter, asymmetric with an oblique flat base and prominent downward process, tunics concentric, light brown, outer layers fragmented somewhat irregularly into sections, often tapering above into short bristles. Cataphyll membranous, solitary. Leaves (2–)3, lin-

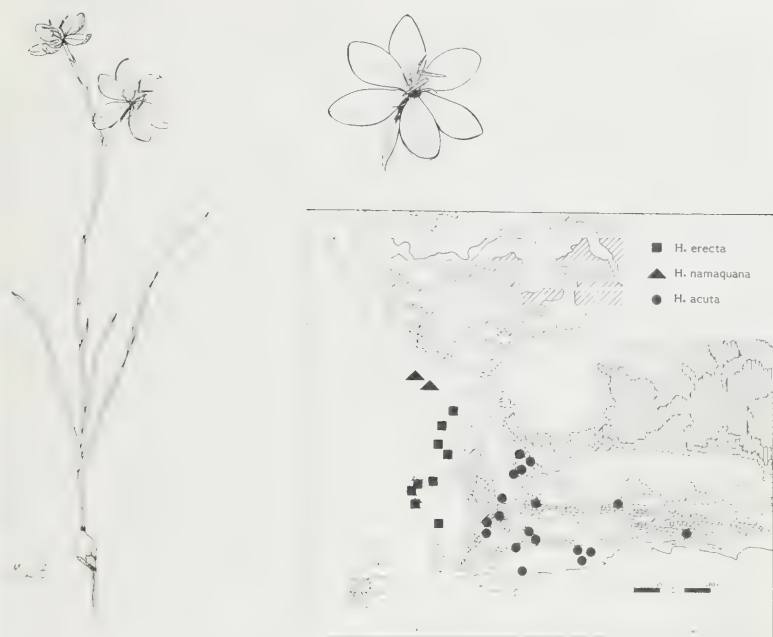


FIG. 9.

Morphology of *Hesperantha acuta* and distribution of *H. erecta*, *H. namaquana* and *H. acuta*. Habit $\times 0.5$; flower life-size (voucher Goldblatt 6373, Ghaap Kop, Matjiesfontein)

ear, short or to half as long as the stem, 2–3 mm wide, midvein evident, upper leaf sheathing lower part of stem, sometimes to base of spike, all basal or uppermost inserted above ground. *Stem* erect, often flexed above sheathing leaf, usually bearing an entirely sheathing bract in upper half. *Spike* flexuose, 2–5(–8)-flowered; *bracts* evidently herbaceous, becoming dry above, and often red-flushed, outer 8–12(–17) mm long, inner shorter. *Flower* hypocrateriform, white or pale yellow; *perianth tube* 8–11(–17) mm long, exserted from bracts; *tepals* 10–17 mm long, ovate, inner shorter and broader. *Filaments* 2–4 mm long; *anthers* 5–7 mm long, articulated. Ovary 2–3 mm long, style branches ca. 8 mm. *Capsule* ovoid, 6–10 mm long. *Chromosome number* $2n = 26$ (Compton 20743).

Flowering time: July–September.

Distribution: from the foot of Van Rhyns Pass in the north, in an arc through the Roggeveld Mountains to the Worcester and Robertson Karoo,

and extending east in the Little Karoo, northern foothills of the Witteberg and Swartberg to the upper Longkloof, in arid situations in clay soils. Fig. 9.

My treatment of *Hesperantha acuta* differs from that of Foster (1948) in my placing *H. discolor* in the synonymy of *H. acuta*. There seems to me no significant differences between the type collections of the two species. Foster also recognised as distinct *H. tugwelliae*, which he described. The only difference between this species and *H. acuta* seems to be its yellow flower colour. *Hesperantha tugwelliae* has clear yellow flowers and *H. acuta* white, but if colour is ignored, or not known, it is impossible to distinguish the two. The type collection of *H. tugwelliae* is particularly robust, with flowers unusually large, but other yellow-flowered collections of *H. tugwelliae* have flowers well within the normal range for *H. acuta*, and there thus seems no justification for maintaining *H. tugwelliae* as a separate species.

The yellow-flowered form of *Hesperantha acuta* occurs in the eastern half of its range, in the Karoo north of the Swartberg, and in the eastern Little Karoo and upper Long Kloof.

The largest and most robust specimens of *Hesperantha acuta* have been collected in the Worcester-Robertson Karoo, and some individuals from this area may have as many as ten flowers, and leaves up to 5 mm wide. Other plants in these same collections are smaller, with narrow leaves, and match well with specimens from the more arid interior. The robust specimens are difficult to distinguish from *H. falcata* in the absence of corms, but when these are present, the ovoid, asymmetric corm of *H. acuta* with concentric tunics immediately establishes their identity.

A collection made by Burchell in 1811, between Sutherland and Fraserburg, *Burchell 1430*, probably between Seleryfontein and Klein Quaggafontein, and perhaps the *Avon-bloem* referred to in his travels (Burchell, 1822:273) is probably a slender-tubed form of *H. acuta*. It is treated as such here, where its two (or three) long and narrow basal leaves, entirely sheathing cauline leaf, and evidently yellow flowers correspond well with the Karoo form of *H. acuta* (*tugwelliae*), recorded, not far to the south near Laingsburg, and at Prince Albert. Baker (1896) referred this specimen to *H. longituba*, an essentially eastern Karoo species which normally has fairly broad leaves, and always white flowers. The specimen at Kew is annotated *H. longituba* var. *angustifolia* Foster, by Foster, but neither this name nor the citation was ever published.

Hesperantha acuta belongs in section *Concentrica* and most individuals I have examined have the slender habit of the group, as well as the characteristic corms. Within the section, *H. acuta* can be distinguished by its three (or two) produced leaves, the upper sheathing the stem for part of its length, and by a short entirely sheathing bract in the upper part of the stem. Very

rarely the bract may be absent in the odd individual in a collection, but all specimens from several collections from the Tanqua Karoo-Koedoesberg area lack this bract. Too little is as yet known about the flora of this poorly collected area to evaluate the significance of this trend. Specimens lacking the stem bract are marked with an asterisk (*) below.

SOUTH AFRICA, CAPE—3119 (Calvinia): Foot of Van Rhyns Pass (-AC), *Lewis* 1986 (SAM); Near Hollerivier, NW of Calvinia (-BC), *Lewis* 2635 (SAM). —3220 (Sutherland): Uitkyk farm, Sneeukskrans (-AD), *Marloth* 9866 (PRE), 9728 (B, PRE, STE); Roggeveld (?-A-B), *Lichtenstein* 453 (B); *Houthoek (-CA), *Hanekom* 477 (PRE); *Tuin Plaas, Tanqua Karoo (-CB), *Marloth* 10373 (MO, PRE, STE); *Koedoesberg (-CC), *Thompson* 1767 (STE); 2 km E Bizansgat farm, S trending slope, *Goldblatt* 6304 (MO).

—3221 (Merweville): SW of Klein Quaggasfontein (near Fraserburg) (-A), *Burchell* 1430 (K).

—3319 (Worcester): Spes Bona, Ceres Karoo (-BB), *Marloth* 10357 (PRE); Hex River Valley (-BC), *Wolley Dod* 4014 (BOL); Karoo Garden, Worcester (-CB), *Compton* 20743 (NBG), *Van Breda* 1749 (PRE), *Barker* 6 (NBG), 4661 (BOL, NBG), *Stayner s.n.* (NBG 87598); Brandvlei, *Hutchinson* 133 (BOL, K, PRE); Near Breede R. bridge, Rawsonville-Worcester, *Lewis* 6047 (NBG); Slopes of Rabiesberg (-DA), *Lewis s.n.* (BOL 31540); Koo valley (-DB), *Loubser* 2062 (NBG); Burger Pass, E of Koo, *Mauve & Oliver* 199 (PRE, STE); Aerodrome, Robertson (-DD), *Van Breda & Joubert* 1937 (PRE).

—3320 (Montagu): Matjiesfontein (-BA), *Logan s.n.* (BOL 31539); Whitehill, *Compton* 11240 (NBG), 14839 (NBG); N slope of Ghaap Kop, *Goldblatt* 6373 (MO); Whitehill Ridge, *Compton* 3505 (BOL, NBG); 14 miles SSE of Laingsburg (-BD), *Acocks* 20513 (K, PRE); Montagu (-CC), *Williams* 65 (NBG); Montagu Baths, *Page* 116 (PRE); Weltevreden, Barrydale (-DC), *Batten* 487 (E).

—3321 (Ladismith): 30 miles from Seven Weeks Poort on Laingsburg road (-AC), *Thomas s.n.* (NBG 93821).

—3322 (Oudtshoorn): Prince Albert (-A), *Tugwell s.n.* (Nat. Bot. Gard. 1151/29 in BOL, K), *Marchand* sub *Marloth* 10311 (B, PRE); Scholz Kloof, S slope, quartzite hills, *Marchand* sub *Marloth* 11257 (PRE); Zebra road near Mt. Hope (-CC), *Moriarty* 584 (NBG); Gt. Doorn R., George distr. (-D-), *Thorne s.n.* (SAM 51701).

—3323 (Willowmore): 7.8 miles WSW of Uniondale (-DA), *Acocks* 20595 (PRE); Rocky hill N of Joubertina (-DD), *Fourcade* 2690 (BOL, K, STE).

—3420 (Bredasdorp): Stormsvlei-Bonnievale (-AA), *Dymond s.n.* (BOL 21239), *Acocks* 1747 (S); 2.5 miles S of Wydgelegen (-AD), *Acocks* 24249 (K, PRE).

—3421 (Riversdale): Riversdale (-AB), *Rust* 45 (B); Roodehoogte, near Herbertsdale (?-B), *Muir* 1438 (BOL); S of Herbertsdale, Gouritz Valley scrub (-BB), *Acocks* 16070 (K, PRE).

4. *Hesperantha montigena* Goldbl., sp. nov. Fig. 10.

Plantae 50–150(–250) mm altae, *cormo* 3–6 mm in diametro, ovato, tunicis concentricis, brunneis, papyraceis, *foliis* 3, inferioribus duobus basilibus, 2–4(–8) mm latis, *spicis* 1–3(–8) floribus, *bracteis* (9–)12–15 mm longis, *floribus* hypocrateriformibus, albis, rubris dorso tepalis exterioribus, *tubo perianthii* primo ca. 12 mm longo, denique 15 mm, *tepalis* 14–16 mm longis, *filamentis* ca. 5 mm longis, *antheris* ad 6 mm longis.



FIG. 10.
Morphology and distribution of *Hesperantha montigena*. Habit and corm life-size;
partial flower and gynoecium $\times 2$ (voucher Esterhuysen 35307, Mt Brodie).

Type: S. Africa, Cape, Milner Peak, Hex R. Mts., 6500 feet, Esterhuysen 35528 (BOL, holotype; K, MO, isotypes).

Plants small to medium, 50–150(–250) mm high. *Corm* \pm elliptic, 3–6 mm in diameter, with an obscure basal process directed downwards, tunics brown, papery, brittle, consisting of several concentric layers, the outer broken irregularly or notched at base and apex, sometimes even becoming fibrous. *Cataphyll* solitary, membranous. *Leaves* 3, 30–90(–200) mm long,

linear to falcate, often obtuse, 2–4(–8) mm wide, lower 2 basal, often prostrate, upper inserted at base or lower part of stem and sheathing stem in lower half. *Stem* erect, unbranched, bearing a sheathing bract leaf in upper half, sometimes with short free apex. *Spike* 1–3(–8)-flowered; *bracts* (9–)12–15 mm long, herbaceous, often flushed red above, inner smaller, and slightly shorter. *Flower* hypocrateriform, white, with red on reverse of outer tepals; *perianth tube* initially ca. 12 mm, extending after anthesis to 15 mm, cylindrical; *tepals* 14–16 mm long, ovate. *Filaments* ca. 5 mm long; *anthers* to 6 mm. *Ovary* 3–4 mm long, style branches ca. 8 mm long. *Capsule* ovoid, to 8 mm long. *Chromosome number* $2n = 26$ (Esterhuysen 35307, 35528).

Flowering time: October–November.

Distribution: Hex River Mountains and Keeromsberg north of Worcester, Riviersonderend Mountains and Simonsberg, at 1 200–2 000 m (4000–6500 feet), shallow soils in damp or shady places, often in mossy banks and seeps. Fig. 10.

Hesperantha montigena is a relatively poorly known species of higher altitudes in the mountains of the interior south western Cape. It grows typically in thin soil on rock ledges or pavement, often in moss, where water accumulates in the wet season, and usually in shady south-facing situations. Its main range is in the rugged Hex River Mountains, but it extends east to Keeromsberg, and has been collected in the south in the Riviersonderend Mountains, and on Simonsberg. Further collecting in suitable habitats may well extend its range. All nine gatherings were made by Elsie Esterhuysen, the well-known Cape botanist, whose knowledge of the Cape mountain flora, where she has collected extensively, is without parallel.

The typical form is easy to recognise by its small size, few but large flowers with the outer tepals red on the reverse, and distinctive ovate to spindle-shaped corm with soft textured, concentric tunics. The concentric tunics of the corm place *Hesperantha montigena* in section *Concentrica* and it is perhaps most closely related to *H. acuta*. Without corms, *H. montigena* is easily mistaken for a dwarf form of *H. falcata* or *H. acuta*.

The collection from Brandwacht Peak, Esterhuysen 10998, most likely belongs here, and it is cited below, but it differs in having smaller flowers and spikes with up to four flowers. Another collection, Esterhuysen 35307, from Mt. Brodie consists of very robust plants, some with several flowers. This population was growing in deeper soil, which may explain the large size of these plants. There seems no reason at present to assign this collection to another species. More material is needed of *Hesperantha montigena* before its variation pattern and species limits can be adequately assessed.

SOUTH AFRICA, CAPE—3318 (Cape Town): Simonsberg, 3500–4000 ft., S aspect (-DD), *Esterhuysen* 35281 (BOL).

—3319 (Worcester): Milner Ridge Peak, Hex River Mts. (-AD), *Esterhuysen* 9352 (BOL); Milner Peak, ledge opposite Milner Needle, 6500 ft., *Esterhuysen* 35528 (BOL, K, MO); Mt. Brodie, shady gully, *Esterhuysen* 35307 (K, MO, NBG, PRE); Shale band from Wit Els Kloof to Buffelshoek Peak, *Esterhuysen* 26374 (BOL, MO); Waaihoek Peak (-CB), *Esterhuysen* 22228 (BOL); Brandwacht Peak, 6000 ft., *Esterhuysen* 10998 (BOL); Keeromsberg, Worcester Div. (-DA), *Esterhuysen* 9228 (BOL); Jonaskop, Riviersonderend Mts. (-DC), *Esterhuysen* 32687 (BOL).

5. *Hesperantha pilosa* (L.f.) Ker, König & Sims. Ann. Bot. 1: 225. 1805; Baker, Flora Cap. 6: 593–60. 1896. Fig. 11.

Ixia pilosa L.f., Suppl. Pl. 92. 1782. Type: South Africa, Cape, hills around Cape Town, *Thunberg s.n.* (Herb. Thunb. 979 UPS, lectotype here designated; S, isoelectotype).

Plants (50–) 100–320 mm high. *Corm* ovoid, 5–12 mm in diameter, asymmetric, with an oblique flat side, tunics light brown, woody, initially entire, but fragmenting vertically into elliptical segments, acuminate at tips. *Cataphyll* solitary or lacking. *Leaves* 3, (30–)80–200 mm long, pilose-puberulent, sometimes pilose below only, linear, 1–10 mm wide, straight, margins and main veins sometimes slightly thickened, lower 2 leaves basal, upper basal or inserted on stem above ground, and sheathing for about half its length, monofacial distally. *Stem* erect, rarely branched, sparsely pilose or glabrous, bearing a membranous to herbaceous scale-like to leafy bract in upper third. *Spike* lightly flexuose, (1–)3–6(–12)-flowered; *bracts* entirely herbaceous or becoming membranous below, dry above, 8–14 mm long, inner narrower, and about as long as outer. *Flower* hypocrateriform, white-cream, to purple, blue, violet, or magenta-pink; *perianth tube* 6–10 (–12) mm long, slender, initially shorter than bracts, later lengthening; *tepals* subequal, 10–15 mm long, narrowly elliptical, 3–5 mm at widest. *Filaments* 2–3 mm long; *anthers* 4–6(–8) mm, articulated. *Ovary* 2–3 mm long, style branches 6–11 mm long. *Capsule* ovoid-oblong, 6–8 mm long. *Chromosome number* $2n = 26$ (subsp. *pilosa* only, Goldblatt 272; 284 as *H. puberula*; 5134, 5810).

Flowering time: (late July–)August–September(–late November at high altitudes).

Distribution: south western Cape and western Karoo from Riviersonderend in the east to the Peninsula and north to Nieuwoudtville and inland from the Langberg near Kliprand, along the Hantamsberg–Roggeveld Escarpment to near Sutherland; on sand or clay, and from flats to high mountains. Fig. 11.

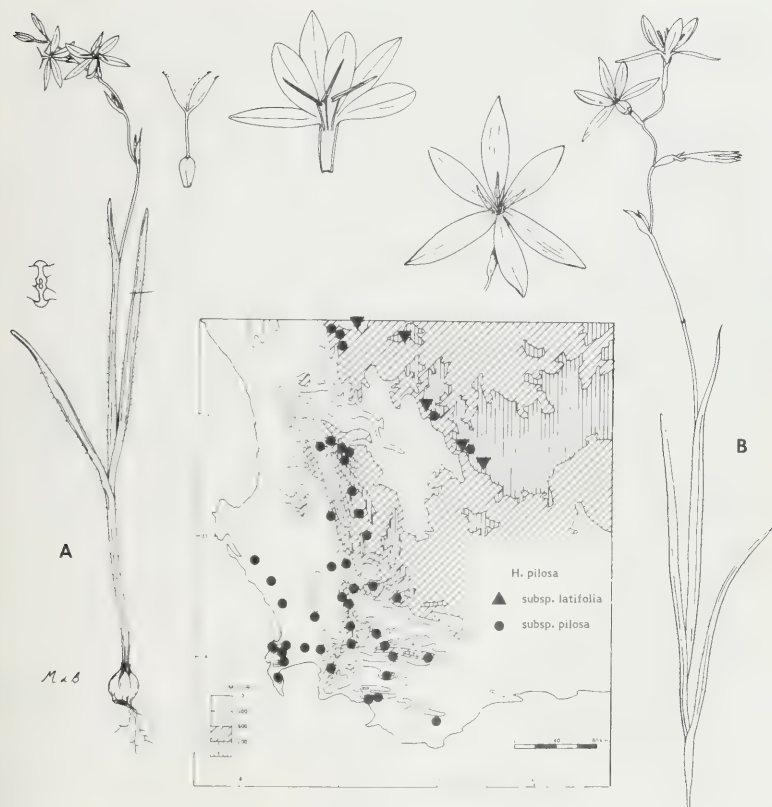


FIG. 11.

Morphology and distribution of *Hesperantha pilosa*. A: *H. pilosa* form from west of Middelpos; B: *H. pilosa* subsp. *pilosa* from Nieuwoudtville. Habits $\times 0.5$; flowers and gynoecium life-size; leaf section much enlarged (vouchers: A: Goldblatt 5810, west of Middelpos; B: Goldblatt 6262, Nieuwoudtville).

Hesperantha pilosa is distinctive in the genus, being the only species in which pubescence is present. Leaves, and often the stems, are covered in a fairly sparse long pubescence. The closely related *H. ciliolata* has minute cilia lining vertical grooves in its leaves, but this is rather different to the hairs found in *H. pilosa*. These two species are however linked by the presence of a peculiar scale-like and usually membranous bract on the upper part of the stem, and they seem certainly to be closely allied.

Although leaves and stems are typically pilose, populations with glabrous stems are not unusual, and are scattered throughout its wide range. The flowers are usually white to cream, with a red to brown flush on the reverse of the outer tepals and are evening-blooming. Other colours have been recorded, most notably along the Nieuwoudtville escarpment, and at Sneeukskrans in the Roggeveld where blue to purple-flowered and day-blooming forms have been recognised as distinct species. These are discussed in more detail under subspecies *pilosa*.

A group of populations extending along the Roggeveld escarpment north west to Calvinia, and into southern Namaqualand share several characteristics which set them apart in *Hesperantha pilosa*. These include a generally robust habit, despite the apparently extreme climate of this region, large corms, broad leaves, large flowers, and a usually large green, pilose stem bract, in contrast to the more usually membranous scale-like bracteole. A few collections from localities to the south west also occasionally have a large subherbaceous stem bract, e.g. *Schlechter 8931* from Bosch Kloof, consists of small to very large plants, a few of which have a large stem bract, and *Goldblatt 272* from Nieuwoudtville consists of one individual with a green bract and another with a membraneous bracteole. Despite the existence of such intermediate individuals, it seems that it would be useful to give formal taxonomic recognition as a subspecies to these populations with large bracts, broad leaves, and somewhat larger flowers.

KEY TO THE SUBSPECIES

1. Plants with white, blue or purple flowers, leaves 1-3(-4) mm wide; stem bracts 1-3(-10) mm long, usually membranous and glabrous ... 2. subsp. **pilosa**
1. Plants with white-cream flowers (darker on reverse of outer tepals); leaves 4-10 mm wide; stem bracts 8-20 mm long, usually herbaceous and pilose 1. subsp. **latifolia**

1. subsp. **latifolia** Goldbl., subsp. nov.

Planta 120-320 mm alta, *cormo* 7-12 mm in diametro, *foliis* lanceolatis, 4-10 mm latis, planis, *caule* glabro, *bractea* herbacea 8-20 mm longa, pilosa, *spica* 1-4(-6) floribus, *floribus* albis, *tubo perianthii* 8-11 mm longo.

Type: S. Africa, Cape, Roggeveld, Sneeukskrans Mt., south of Voëlfontein farm house, ca. 4500 ft., *Goldblatt 6339* (MO, holotype; K, NBG, isotypes).

Plants 120-320 mm high. *Corm* 7-12 mm in diameter. *Leaves* lanceolate, 4-10 mm wide, plane. *Stem* smooth, bearing a more or less herbaceous, pilose leaf-like bract 8-20 mm long. *Spike* 1-4(-6)-flowered. *Flowers* white, red to brownish on reverse of outer tepals; *perianth tube* 8-11 mm long.

Flowering time: September to early October.

Distribution: Roggeveld escarpment and north on the Hantamsberg and in southern Namaqualand. Fig. 11.

Subspecies *latifolia* comprises a distinct series of populations of *Hesperantha pilosa* which extend along the Roggeveld escarpment north into southern Namaqualand. It can easily be distinguished by well-developed, more or less herbaceous and pilose stem bracts, and broad leaves. Both subsp. *latifolia* and subsp. *pilosa* occur on the Roggeveld escarpment, and remain quite distinct. In this area, subsp. *pilosa* grows in large colonies in damp flat sites, while subsp. *latifolia* is scattered in stony, usually well-drained situations, either on flats or mountain slopes.

SOUTH AFRICA, CAPE—3018 (Kamiesberg): W of Langeberg towards Kliprand (-DB), *Lavranos s.n.* (PRE 58854).

—3119 (Calvinia): Hantamsberg plateau (-BD), *Goldblatt* 278 (BOL), *Goldblatt* 5830 (MO); De Hoop, N end of Roggeveld escarpment (-DD). *Thompson* 2533 (PRE, STE).

—3220 (Sutherland): Roggeveld, NW of Sutherland, Quaggasfontein, roadside on way to Uitkyk, 4700 ft (-AB), *Goldblatt* 6349 (MO); Sneeuks Mt. S of Voëlfontein farm house, ca. 4500 ft (-AD), *Goldblatt* 6339 (K, MO, NBG).

2. subsp. *pilosa*. Fig. 11.

Hesperantha puberula Schltr. ex Foster, Contr. Gray Herb. 166: 22. 1948. Type: S. Africa, Cape, Oorlogskloof (Nieuwoudtville), *Schlechter* 10952 (B, lectotype here designated; B, BOL, G, GRA, K, PRE, US, isotypes).

Hesperantha bracteolata Foster, Contr. Gray Herb. 166: 6. 1948. Type: S. Africa, Cape, Sutherland, Uitkyk farm, *Marloth* 9907 (B, holotype; PRE, isotype).

Plants (50–)100–200(–300) mm high. *Corm* 4–7 mm in diameter. *Leaves* linear, 1–3(–4) mm wide, margins occasionally thickened. *Stem* pilose or smooth, with a membranous scale-like bract 1–3(–10) mm long in upper half. *Spike* (1–)2–6(–12)-flowered. *Flowers* white, blue, or purple; *perianth tube* 6–10 mm long; *tepals* 10–12(–15) mm long.

Flowering time: (late July–)August–September(–late November at high elevations).

Distribution: south western Cape north to Nieuwoudtville, and scattered along the Roggeveld escarpment edge. Fig 11.

This is the more common of the two subspecies of *Hesperantha pilosa* and it occurs in a wide variety of situations throughout the south western Cape. It is fairly variable in size, individuals ranging from only 50 mm high

with one or two flowers to 300 mm with as many as 12 flowers. There is no clear pattern to this variation which seems dependent on ecological conditions rather than genetic variability. All forms have the characteristic narrow, relatively long leaves, and unusual, short membranous, scale-like bract, in the upper part of the stem. Occasionally, a robust individual may have a larger stem bract, sometimes up to 15 mm long, but this is a rare and isolated condition. Flower colour varies in subsp. *pilosa* to an unusual degree for the genus. While most populations consist of white-flowered plants which are evening-blooming, there are scattered populations of blue to purple-flowered, day-blooming plants. The most well-known of the coloured forms occurs on the Nieuwoudtville escarpment where plants with blue flowers occur from Grasberg in the north, to Lokenburg in the south.

Typical, white-flowered populations (*Goldblatt* 272, 6265A) also grow in this area and appear to differ in no significant morphological feature from the blue-flowered form which was described as a distinct species, *H. puberula*, by Foster (1948).

Another colour variant is *H. bracteolata* which Foster described from a Marloth collection from Sneekrans in the Roggeveld, which consisted of rather dwarfed plants with purple flowers. This was recently recollected (*Goldblatt* 6316) in 1981, a year of ample rainfall, and plants were no smaller than other forms of *H. pilosa*, although they differed consistently in their dark purple flower colour. Other blue to purple colour variants have been collected at scattered sites to the south, at Dassenberg, near Darling, and in the Caledon district. There is no pattern to the distribution of the races or forms with coloured flowers, and it seems likely that mutations for coloured, day-blooming flowers have occurred repeatedly in *H. pilosa*. None of the variant colour forms has any significant morphological feature setting it apart, and it seems preferable not to recognise any of these as distinct taxa.

A collection from the Roggeveld near Blomfontein, SE of Calvinia, *Goldblatt* 5810, consists of plants which have raised and thickened leaf margins and midrib. The stem bract in this population sample ranges from membranous and scale-like to subherbaceous and almost 10 mm long. The flowers of this population are also unusual in being secund with a slightly curved perianth tube (Fig. 11A).

SOUTH AFRICA, CAPE—3119 (Calvinia): Nieuwoudtville (-AC), *L. Bolus* s.n. (BOL 21069, SAM 52377); Nieuwoudtville town lands, *Lavranos* 10904 (MO); Groenrivier, S of Nieuwoudtville, *Goldblatt* 284 (BOL); Oorlogskloof hills, *Schlechter* 10952 (B, BOL, G, GRA, K, PRE, US); Oorlogskloof, hill 2 miles N of village, *Nordenstam* 739 (M, S); Grasberg road, NW of Nieuwoudtville (-AC), *Goldblatt* 272 (BOL), 6265A (MO), 6262 (MO, PRE, US); Lokenburg, 2300 feet (-CA), *Acocks* 17048 (PRE); 56 km SE of Calvinia on Blomfontein road (-DD), *Goldblatt* 5810 (K, MO, NBG, PRE, S, US).

- 3218 (Clanwilliam): Near Clanwilliam Dam (-BB), *Lewis & Davis 2495* (SAM); Bosch Kloof, *Schlechter 8931* (B, G, K, L, MO, P, PH, PRE, S, US, Z).
- 3219 (Wuppertal): Uityk Pass, Cedarberg (-AC), *Lewis s.n.* (BOL 22269), *Barker 261* (NBG); Shale band, E slopes of Sneeuberg, *Esterhuysen 13092* (BOL); Mid-delberg vlakte, *Goldblatt 5134* (B, MO, US); Elands Kloof (-CA), *Barker 3798* (NBG), *Compton 16239* (NBG); Duiwelsgat slopes, S Cedarberg, *Esterhuysen 13141* (BOL); Wabooms Rivier, Cold Bokkeveld (-CC), *Lewis 2508* (SAM); Near De Keur, *Lewis 1402* (PRE, SAM).
- 3220 (Sutherland): Farm Uityk, Sneeuksrans, top of cliffs (-AD), *Marloth 9907* (B, PRE, STE); Voëlfontein farm, NW of Sutherland, *Goldblatt 6310* (K, MO, NBG).
- 3318 (Cape Town): Hills round Darling (-AD), *H. Bolus s.n.* (BOL 12838); Mamre hills, *Compton 14964* (NBG); Groenekloof, *Drège s.n.* (K); Lucasfontein near Oupos Hotel (-BA), *Acocks 24314* (MO, PRE); Porterville (-BB), *Loubser 458* (NBG); Malmesbury (-BC), *Barker 2547* (NBG); Slopes of Lion's Head (-CD), *Drège s.n.* (SAM), *Barker 3867* (NBG); Near Kenilworth, *H. Bolus s.n.* (BOL 8026); Rosebank, *H. Bolus s.n.* (BOL 3767, K, PRE), *Schlechter 1038* (B, BOL, G, GRA, Z); Foot of Table Mt., *Pappe s.n.* (S); Cairn Ravine, Table Mt., *Esterhuysen 9017* (BOL); Devil's Peak, *Wolley Dod 585* (BOL, K), *Wilms 3700* (WU, Z), *Tyson 2480* (GRA, NBG, PRE); Table Mt., *Drège 1550* (B), *Ecklon 399* (B, G, K, MO, PRE, S, Z); S end of Dassenberg (-DA), *Pillans 6860* (BOL); Paarl, 6.4 miles WNW of Windmill (-DB), *Acocks 2440* (PRE); Langverwacht, Kuils River (-DC), *Oliver 4654* (STE); Stellenbosch flats (-DD), *Garside 83* (K).
- 3319 (Worcester): Tulbagh (-AC), *L. Bolus s.n.* (STE); Wet flats, Romans River Nature Reserve, *Goldblatt 6288* (MO, WAG); Gouda (Piketberg Road), *Schlechter 4850* (B, G, K, P, PRE, Z); N facing slopes of Hex R. Mts. above Ezelsfontein on plain above marsh on Milner Vlake (-AD), *Esterhuysen 35530* (BOL, MO, PRE, S, US, WAG); Baviaans Kloof, Wellington (-CA), *Leighton 2160* (BOL); Wellington, *Cummings s.n.* (GRA); French Hoek Pass, 2200 ft (-CC), *Barker 4142* (NBG); Wemmershoek Mts., *Esterhuysen 9061* (BOL); Keeromsberg, 3000–4000 ft (-DA), *Esterhuysen 9229* (BOL).
- 3418 (Simonstown): Near Bergvliet (-AB), *Salter 7645* (SAM); Firgrove hill, Bergvliet farm, *Purcell s.n.* (MO, SAM 93334); Flats near Constantia, *Krauss 1391* (MO); Near Simonstown, *Schlechter 1089* (B, GRA, Z); Oatlands, *Wolley Dod 2978* (K); Sir Lowry's Pass (-BB), *Schlechter 1129* (B, Z).
- 3419 (Caledon): Flats E of Viljoens Pass (-AA), *Davis s.n.* (SAM); Caledon Zwartberg (-AB), *Ecklon & Zeyher s.n.* (P, Z); Fern Kloof Nature Reserve, Hermanus (-AC), *Robertson 470* (MO); Hermanus, hillside above Mossel R. (-AD), *Compton 23643* (NBG); 2 miles E of Hermanus, *Gillett 4466* (BOL); Foot of Riviersonderend Mts. (-B), *Stokoe 8941* (BOL, SAM); Genadendal (-BA), *Prior s.n.* (K), *Verreaux 1831* (G); Flats at Mierkraal, S of Bredasdorp (-DB), *Goldblatt 6182* (MO).

Without precise locality: *Thunberg s.n.* (S, UPS); Caledon Zwartberg und Umgegend des Bades, *Ecklon & Zeyher 235* (B, G, K, LD), *51.8* (C, GH, UPS); *Drège s.n.* (G, P, Z); *Roxburgh s.n.* (G); *Verreaux 1831* (G); *Krauss 1841* (G).

6. *Hesperantha ciliolata* Goldbl., sp. nov.

Planta 150–300 mm alta, *cormis* ignotis, *foliis* 3, basalis, linearibus, 2–3 mm latis, costatis, ciliolatis, caule membranacea bractea in parte superiore, *spicis* 5–7 floribus, *bracteis* 10–13 mm longis, membranaceis,

floribus stellatis violaceis, *tubo perianthii* 3–4 mm longo, *tepals* 12–14 mm longis, *filamentis* ca. 2 mm longis, *antheris* 6–7,5 mm longis.

Type: S. Africa, Cape, Geelhoek, Sutherland distr., *Acocks 17176* (PRE, holotype).

Plants 150–300 mm high. *Corm* unknown. *Cataphyll* solitary, membranous. *Leaves* 3, all basal, linear, erect to slightly outcurving, with 4–5 longitudinal grooves, alternating with ribs, and lined with cilia, uppermost leaf sheathing stem for ca. two-thirds of its length, with produced apex. *Stem* erect, flexed below inflorescence, unbranched, bearing a membranous, transparent, sometimes scale-like stem bract 3–10 mm long, above or at apex of leaf sheath. *Spike* 5–7-flowered; *bracts* evidently dry and membranous, 10–13 mm long, inner narrower and slightly shorter than outer. *Flower* violet, stellate; *perianth tube* 3–4 mm long, cylindric, included in bracts; *tepals* subequal, 12–14 mm long, obovate, ca. 5 mm wide. *Filaments* ca. 2 mm long, inserted at top of tube; *anthers* 6–7,5 mm long. Ovary ca. 2 mm long, style branches 7–8 mm long. *Capsule* and seeds unknown. *Chromosome number* unknown.

Flowering time: mid-September–October.

Distribution: Roggeveld escarpment, Sutherland district, sandy flat places, known only from Geelhoek. Fig. 12.

Hesperantha ciliolata is known only from a single collection, which in fact lacks a corm. Other features, especially the membranous and scale-like stem bract are reminiscent of *H. pilosa*, and it seems likely that it belongs in section *Concentrica*, close to *H. pilosa*. These two species are the only two in the genus in which pubescence of any sort is developed. *H. pilosa* has rather sparse, long hairs, while *H. ciliolata* has very small cilia which line the grooves that run the length of the leaves.

SOUTH AFRICA, CAPE—3220 (Sutherland); Geelhoek, sandy flats in Mountain Renosterveld (-BC), *Acocks 17176* (PRE).

7. *Hesperantha rivulicola* Goldbl., sp. nov. Fig. 12.

Plantae 150–300 mm altae, *cormo* 7–10 mm in diametro, globoso, tunicis concentricis, *foliis* 3–4, basalis vel superioribus supra terram insertis, ad 2 mm latis, *spicis* 2–5 floribus, *bracteis* 9–12 mm longis, *floribus* stellatis albis, brunneis dorso *tepals* exterioribus, *tubo perianthii* 7–10 mm longo, *tepals* ad 15 mm longis, *filamentis* 3 mm longis, *antheris* ca. 6 mm longis.

Type: S. Africa, Cape, streambeds below the Hantamsberg at Calvinia, *Goldblatt 5807* (MO, holotype; B, BOL, E, K, NBG, PRE, S, US, WAG, isotypes).

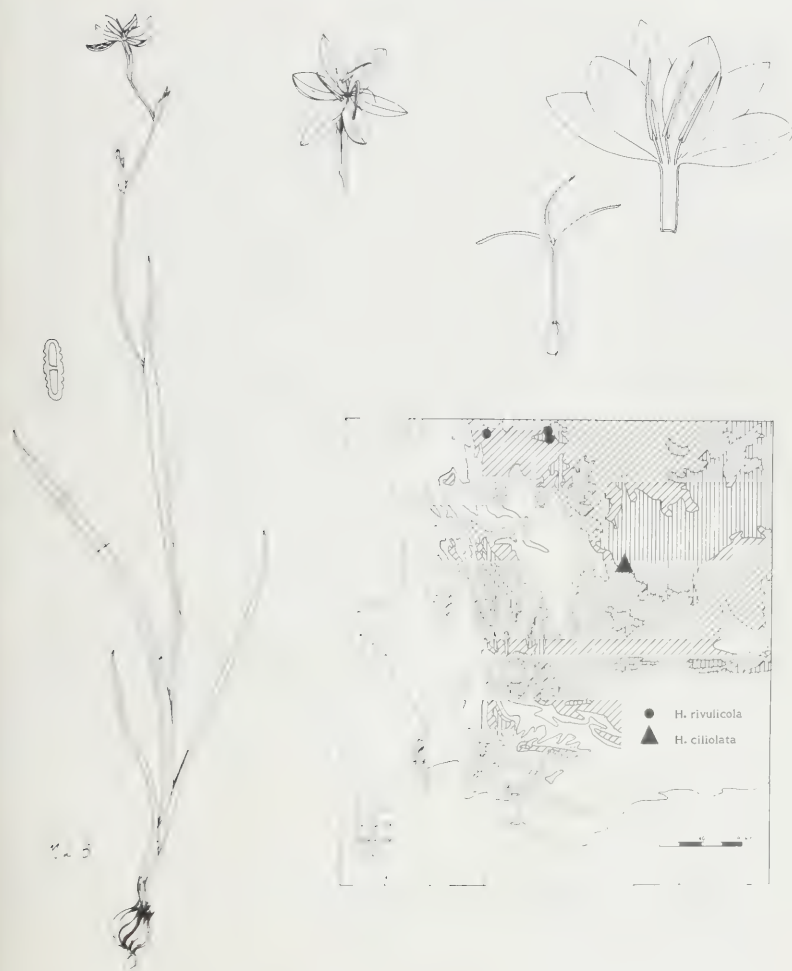


FIG. 12.

Morphology of *Hesperantha rivulicola* and distribution of *H. rivulicola* and *H. ciliolata*. Habit $\times 0,5$; flower life-size; opened flower and gynoecium $\times 2$ (voucher Goldblatt 5807, Hantamsberg flats).

Plants 150–300 mm high. *Corm* globose, 7–10 mm in diameter, tunics brown, concentric, inner layer unbroken, outer fracturing vertically into elliptic segments tapering to points at tips. *Cataphyll* solitary, membranous. *Leaves* 3–4 inner, straight, reaching to midpoint of stems or to inflorescence, to 2 mm wide, pale green, slightly inflated, all basal, or upper inserted on stem shortly above ground, uppermost sheathing lower half of stem, with free apex. *Stem* solitary, or 2–3-branched, main axis dividing at base of leaf sheath, erect. *Spike* flexuose, 2–5-flowered; *bracts* 9–12 mm long, green below, becoming dry above, inner as long, but narrower than outer. *Flower* white, stellate, opening at sunset, and then sweet-scented, outer tepals brownish on reverse, with a dark central line; *perianth tube* straight, cylindric, 7–10 mm long; *tepals* subequal, outer lanceolate, to 15 mm long, 4.5 mm wide, inner elliptic, to 14 mm long and 5 mm wide. *Filaments* 3 mm long; *anthers* ca. 6 mm long, articulated and horizontal. *Ovary* ca. 2 mm long, style branches ca. 8 mm long, spreading. *Capsule* unknown. *Chromosome number* $2n = 26$ (Goldblatt 5807).

Flowering time: September

Distribution: local in wet sand in the courses of seasonal streams near Nieuwoudtville and Calvinia. Fig. 12.

Hesperantha rivulicola is known from only a few collections in the Nieuwoudtville–Calvinia area of the north western Cape. It is apparently restricted to seasonal seeps and streams and grows in or near running water. The general appearance of the plant is much like that of a slender *H. falcata* or *H. acuta* and it has the unspecialised white flowers characteristic of these species. The corms are, however, small and of the concentric type while the leaves are distinctive in being pale green, linear, and slightly inflated. The spike is generally rather few-flowered. The flowers open at sunset and close again at first light.

SOUTH AFRICA, CAPE—3119 (Calvinia): In stream at Van Wyk's farm, Nieuwoudtville (-AC), *L. Bolus* s.n. (BOL 21065, K, NBG, PRE, SAM); Stream beds below Hantamsberg, Calvinia (-BC), Goldblatt 5807 (B, BOL, E, K, MO, NBG, PRE, S, US, WAG); Akkerendam, Calvinia, in water, Acocks 18497 (K, PRE), Leistner 354 (PRE).

8. *Hesperantha quadrangula* Goldbl., sp. nov.

Plantae 100–300 mm altae, *cormo* 6–8 mm in diametro, globoso, tunicis \pm concentricis, cataphyllis atrobrunneis, *foliis* 3, basalibus duobus interioribus, 3–7 mm latis obtusis, superiore quadrangulo in sectione vaginante, *spicis* 1–8 floribus, *bracteis* 7–9 mm longis, membranaceis supra, *floribus* stella-

tis, albis, carneis dorso tepalis exterioribus, *tubo perianthii* 2–3 mm longo, *tepals* 9–12 mm longis, *filamentis* ca. 3 mm longis, *antheris* 3–4 mm longis.

Type: S. Africa, Cape, Hantamsberg at Calvinia, below plateau cliffs, *Goldblatt* 5795 (MO, holotype).

Plants 100–300 mm high. *Corm* globose, 6–8 mm in diameter, tunics brown, concentric, notched below and above, and breaking into irregular sections. *Cataphyll* single, dark brown, brittle-membranous. *Leaves* 3, all basal, lower two 30–80(–100) mm long, diverging, relatively broad, 3–7 mm wide, obtuse, uppermost sheathing lower half two-thirds of stem, quadrangular in section when live, with short free apex ca. 10 mm long. *Stem* erect, simple, without bracts. *Spike* 1–7-flowered; *bracts* herbaceous below, membranous above, 7–9 mm long, inner narrower than outer. *Flower* white, stellate, outer tepals suffused with pink on reverse; *perianth tube* 2–3 mm long, included in bracts; *tepals* 9–12 mm long, narrowly obovate. *Filaments* ca. 3 mm long; *anthers* 3–4 mm long. Ovary to 4 mm long; style branches to 5 mm long. *Capsule* and seed not known. *Chromosome number* unknown.

Flowering time: September.

Distribution: heavy clay soil in stony ground on the plateau and upper slopes of the Hantamsberg, above Calvinia. Fig. 13.

Hesperantha quadrangula has been collected only on the slopes and summit plateau of the Hantamsberg at Calvinia, and is, so far, known from just two gatherings. The plants vary considerably in size, from 100 to 300 mm high, and have between one and eight flowers. The species has small globose corms with dark, rather irregularly broken tunics, apparently of the concentric type, and it is referred to section *Concentrica*. Its affinities are obscure, but it may be related to *H. acuta*, a Roggeveld species with large flowers. *Hesperantha quadrangula* can be recognised immediately by its dark brown cataphyll, two broad, obtuse basal leaves, and a third, almost entirely sheathing leaf which is quadrangular in section. Its flowers are comparatively small for the genus, with tepals 9–12 mm long, and have an unusually short perianth tube only 2–3 mm long, and enclosed in the bracts.

SOUTH AFRICA, CAPE—3119 (Calvinia): Western end of Hantamsberg at Calvinia, below plateau cliffs, S aspect (-BC), *Goldblatt* 5795 (MO); Hantamsberg plateau, southwestern end, *Goldblatt* 5830A (MO).

9. *Hesperantha flexuosa* Klatt, Abh. nat. Ges. Halle 15: 394 (Ergänz. 60). 1882; Baker, Flora Cap. 6: 59. 1896; Foster, Contr. Gray. Herb. 6: 166; 13. 1948. *Type:* S. Africa, Cape, Namaqualand, Elboogfontein, *Drège* 2639 (B, "Herb. Lübeck" holotype; G, isotype). Fig. 13.

Hesperantha namaquensis Baker, Handbk. Irid. 149: 1892. Type: S. Africa, Cape, Namaqualand, Scully 50 (K, holotype).

Hesperantha bolusii, Foster, Contr. Gray Herb. 166: 6. 1948. Type: S. Africa, Cape, Namaqualand, Nababeep, Bolus s.n. in Herb. Norm. Aust. Afr. 694 (G, holotype; B, BOL, G, K, PRE, SAM, UPS, isotypes).

Hesperantha albiflora Schltr. ms., Brakdam, Namaqualand, Schlechter 11125.

Plants (60–)100–200 mm high. Corm ovoid, asymmetric, to 3–6 mm in diameter, tunics dark brown, woody, outer layers fragmenting vertically, often into elliptic segments tapering at base and apex, base with a well-developed lateral process. Cataphyll membranous, evidently solitary. Leaves usually 3, lower 2 basal, linear-filiform, 0.5–1.5 mm wide, erect to falcate, third leaf basal or inserted above ground, sheathing for half its length. Stem erect, simple, rarely with a single branch from cauline node, often flexed above leaf sheath. Spike flexuose, 4–7-flowered; bracts evidently membranous, dry in upper half, 7–10 mm long, inner usually slightly shorter. Flower hypocrateriform, white, sweet-scented, outer tepals sometimes darker on re-



FIG. 13.

Morphology of *Hesperantha flexuosa* and distribution of *H. flexuosa*, *H. quadrangula* and *H. minima*. Habit $\times 0.5$; flower life-size; gynoecium and opened flower $\times 2$ (voucher Goldblatt 5763, Kamiesberg).

verse; *perianth tube* 5–9(–10) mm long, ovoid, to 5 mm wide; *tepals* 8–13 mm long, 3.5–5 mm wide. *Filaments* ca. 3 mm long; *anthers* 4.5–6 mm long. Ovary 2–3 mm; style branches usually slightly shorter than stamens. *Capsule* ovoid, 5–6 mm long. *Chromosome number* $2n = 26$ (Goldblatt 191).

Flowering time: August–September(–October at higher altitudes).

Distribution: fairly common in Namaqualand in granite-derived sand, usually in wetter sites. Fig. 13.

This typically dwarf, slender species is endemic to the Kamiesberg and northern Namaqualand. It grows on the coarse grained granitic sand of the area, often in damper situations such as washes or south-trending slopes. The species appears to be common, but is very inconspicuous because of its small size, and because the flowers only open in the evening. The very slender, linear leaves are characteristic, with the two lower being basal, and the third usually inserted above ground level. The thin stem is typically flexed above the sheathing part of the upper leaf, and always lacks a cauline bract.

Hesperantha flexuosa is related, on the one hand, to the dwarf, small-flowered Kamiesberg endemic, *H. minima*, and to *H. erecta* on the other. *Hesperantha erecta* is native to the Cape west coast, south of the Olifants River, and is usually a robust, several-branched and broad-leafed species. Depauperate plants, however, resemble *H. flexuosa* closely, and may be difficult to separate.

SOUTH AFRICA, CAPE—2917 (Springbok): Near Nababeep (-DB), *H. Bolus* in Herb. Norm. Aust. Afr. 694 (B, BOL, G, K, PRE, SAM); Granite hill west of Springbok, *Goldblatt* 532 (BOL); Near van der Stel's mine, east of Springbok, *Goldblatt* 191 (BOL); Wildeperdehoek Pass, S facing slopes, *Goldblatt* 5755 (K, MO, S).

—3017 (Hondeklipbaai): Grootvlei (-BB), *Barker* 3717 (NBG), *Lewis* 1382 (SAM), *Leighton* 1230 (BOL); Noheep, farm Arakooop, *Thompson & LeRoux* 43 (K, PRE, STE); Elboogfontein, *Drège* 2639 (B, G, tracing S); Brakdam hills (-BD), *Schlechter* 11125 (B, BOL, G, GRA, K, L, MO, P, PH, PRE, S, US).

—3018 (Kamiesberg): Top of Kamiesberg Pass (-AA), *Goldblatt* 5763 (MO, PRE, S); Foot of Wilgehout ravine (-AC), *Pearson* 6733 (BOL, K); De Kom (farm Karas) 3 miles from Leliefontein, *Leipoldt* 3587 (BOL); Sneekop, *Pearson s.n.* (L).

Without precise locality: Little Namaqualand, *Scully* 50 (K); Namaqualand, *Wyley s.n.* (K); Garies–Okiep, *Marloth* 6743 (PRE, STE).

10. *Hesperantha minima* (Baker) R.C. Foster, *Contr. Gray Herb.* 135: 77. 1941 et *Contr. Gray Herb.* 166: 20. 1948.

Geissorhiza minima Baker, *J. Bot.* 14: 239. 1876 et *Flora Cap.* 6: 75. 1896. Type: South Africa, Cape Kamiesberg, “Modderfonteinsberg” mountains near Modderfontein, *Drège* 2632 (K, lectotype designated by Foster; B, G, K, L, MO, P, S, isolectotypes).

Plants small, 40–50 mm high. *Corm* small, ovoid, tunics unknown. *Cataphyll* membranous, apparently solitary. *Leaves* 3, linear, falcate, less than 1 mm wide, 20–30 mm long, lower 2 basal, upper basal or inserted shortly above ground, and sheathing lower part of stem. *Stem* erect, sheathed below by upper leaf, simple or 1-branched. *Spike* 1–3-flowered; *bracts* 3–5 mm long, herbaceous below, membranous and dry above, and red-flushed, inner slightly smaller. *Flower* small, evidently hypocrateriform, white, with darker colour on reverse of outer tepals; *perianth tube* 4–5 mm long, well exerted from bracts; *tepals* 5–6 mm long, ovoid. *Filaments* ca. 1 mm long; *anthers* 2–3 mm long. *Ovary* 1–1.5 mm long, style branches ca. 3 mm long. *Capsule* unknown. *Chromosome number* unknown.

Flowering time: October–early November.

Distribution: “Modderfonteinsberg”, 1 200–1 500 m (4000–5000 feet), Kamiesberg. Fig. 13.

This tiny species, known only from the type gathering made by Drège in 1839 in the Kamiesberg, is probably a high altitude endemic of extremely limited distribution. It appears related to *Hesperantha flexuosa* which has a wide distribution in Namaqualand but corms are not known and its correct relationships thus remain uncertain. The flowers are among the smallest in the genus, but they are otherwise unremarkable.

SOUTH AFRICA, CAPE—3018 (Kamiesberg): Modderfonteinsberg, Kamiesberg (-AC), Drège 2632 (B, G, K, L, MO, P, S).

11. *Hesperantha fibrosa* Baker, Handbk Irid. 149. 1982, et Flora Cap. 6: 61. 1896; Foster, Contr. Gray Herb. 166: 11. 1948. Type: S. Africa, Cape, Kleinriviersberg, Zeyher 3960 (K, lectotype here designated; B, G, K, S, SAM, W, Z, isolectotypes). Fig. 14.

Plants 80–300 mm high. *Corm* ovoid, 8–12 mm in diameter, asymmetric, with an oblique flat side, tunics dark brown, concentric, outer layers fragmenting into vertical segments, drawn into long fibres above. *Cataphyll* solitary, membranous, brown when dry. *Leaves* 3 (or third bract-like), lower 2 basal, 40–100 mm long, ensiform, sometimes succulent or more usually margins and midrib thickened, 2–4 mm wide, upper inserted on stem above the ground, and sheathing stem for most of its length. *Stem* erect, unbranched. *Spike* flexuous, (1–)3–6-flowered; *bracts* 9–14 mm long, herbaceous, inner \pm as long as outer, narrower. *Flower* hypocrateriform, pink to violet-purple; *perianth tube* 7–10 mm long, barely emerging from bracts; *tepals* spreading, ca. 10 mm long, ovoid, spreading. *Filaments* 3–4 mm long; *anthers* ca. 4 mm long. *Ovary* ca. 2 mm, style branches 6 mm long. *Capsule* oblong, 6–8 mm long. *Chromosome number* $2n = 26$ (Goldblatt 6199).



FIG. 14.

Morphology and distribution of *Hesperantha fibrosa*. Habit $\times 0,5$; flower life-size; leaf sections $\times 2$ (voucher *Goldblatt* 6101, Mierkraal, including upper leaf section; lower leaf section *Goldblatt* 6199, Caledon).

Flowering time: July–August (–early October).

Distribution: southern Cape, from Houw Hoek in the west, to Heidelberg in the east (a record from Elands Kloof, Clanwilliam Division is doubtful). Fig. 14.

Hesperantha fibrosa is rather poorly collected, and if the record correctly

reflects the situation, it is rare, although distributed over a fairly wide area. It is apparently a species of lower mountain slopes or flats and it grows either in stony or sandy soil. It is possible that the paucity of collections is partly due to infrequent flowering which may occur well only after veld fires.

At first glance this species appears to be a member of the *Hesperantha falcata* complex, but the corms are typical of section *Concentrica*. The brown corms are distinctive in the way that they fragment into elliptical segments with the upper ends produced into long stiff fibres, a character unique in this section. The leaf of *H. fibrosa* is also unusual in having thickened margins and midrib, this very pronounced in some populations, but little in others such as *Smith* 2978 (Nachtwacht) and *Acocks* 24037 (WNW of Heidelberg). The latter collection has been assigned to *H. fibrosa* with some hesitation. The leaf number and arrangement, inflorescence, habit, and flower colour match *H. fibrosa* well, but the characteristic long stiff fibres of the corm tunics are not developed.

SOUTH AFRICA, CAPE—3419 (Caledon): Near Houwhoek (-AA), *H. Bolus s.n.* (BOL 22709); N slope of Kleinrivier Mts. between Major Shaw and Tesselaars (-AD), *Zeyher* 3960 (B, G, K, S, SAM, W, Z); Swartberg, Caledon and near the Baths (-AB), *Ecklon & Zeyher Irid.* 239 (B, G, LD, P, S, SAM); Clay flats S of Caledon, *Goldblatt* 5899 (MO), 6199 (MO, NBG); Caledon–Napier (-BC), *Esterhuysen* 3055 (BOL); Clay flats, Mierkraal farm SW of Bredasdorp (-DB), *Goldblatt* 6101 (K, MO, NBG, PRE, S), 6181 (MO).

—3420 (Bredasdorp): Hills 8 miles WNW of Heidelberg (-BB), *Acocks* 24037 (K, PRE); Farm Nachtwacht, Rietheuwels, Bredasdorp distr. (-CA), *Smith* 2978 (BOL, PRE).

Doubtful locality:—3219 (Wuppertal): Elands Kloof (-CA), *Esterhuysen* 3160 (BOL).

Section IMBRICATA

2. Section *Imbricata* Goldbl., Ann. Missouri Bot. Gard. 69: 376. 1982.

Corm \pm asymmetric, with one side flattened, and sometimes extending downwards for a short distance, tunics imbricate, outer layers overlapping inner above only, usually fragmenting regularly below into even-sized sections, sometimes drawn into points above, usually very woody in texture. *Flower* actinomorphic, white, pink, purple, yellow, sometimes with dark contrasting markings, small to large, tube well exerted from bracts in several species, perianth tube curved in *H. bachmannii* and *H. bulbifera*. Plants caulescent or acaulescent, and then with large bracts.

Distribution: centred in western southern Africa, mainly in arid areas; Namaqualand to Transvaal.

Species: 12, all found within the winter rainfall area.

Type species: H. humilis Baker

Section *Imbricata*, comprising some 12 species is centred in the western Karoo, but in fact extends from northern Namaqualand through the Karoo to the Transvaal. An acaulescent habit is developed in three species, *H. humilis* and *H. hantamensis* of the western Karoo, and *H. flava* which is known from northern Namaqualand and the Laingsburg district of the Karoo. Two species have a curved perianth tube, the widespread *H. bachmannii* and *H. bulbifera*, which occurs in the eastern Cape and at isolated montane sites in the Transvaal. Local endemics include the long-tubed *H. pallescens* from the western Cape, and *H. oligantha*, *H. karooica*, and *H. purpurea*, all from the Calvinia district of the western Karoo. The most striking species is *H. vaginata*, the common form of which has large, deep yellow flowers with contrasting dark brown markings.

12. ***Hesperantha longituba*** (Klatt) Baker, Gard. Chron. 7: 652. 1877; Flora Cap. 6: 64. 1896; Foster, Contr. Gray. Herb. 166: 19. 1948 pro parte excl. syn. *Acidanthera huttonii*.

Geissorhiza longituba Klatt, Linnaea 35: 383. 1867/8. Types: S. Africa, Cape, Somerset East, *Bowker s.n.* ("Sommasch, Bourker") [K, lectotype here designated (K, S, isoelectotypes)]; Orange Free State, *Cooper 746* (K, syntype; E, G, K, PRE, Z).

Hesperantha candida Baker, Handbook Irid. 151: 1892 et Flora Cap. 6: 62–63. 1896. Type: S. Africa, Orange Free State, *Cooper 746* (K, lectotype here designated; E, G, K, PRE, Z, isoelectotypes) (specimen at E may be a different species).

Hesperantha candida var. *bicolor* Baker, Flora Cap. 6: 63. 1896. Type: S. Africa, Cape, Boschberg, Somerset East, 4000 feet, *MacOwan s.n.* in Herb. Norm. Aust. Afr. 61 (K, lectotype effectively designated by Foster (1948: 5); BOL, G, GRA, M, US, WU, Z, isoelectotypes).

Hesperantha bicolor (Baker) Foster, Contr. Gray Herb. 166: 5. 1948.

Plants (60–)150–300 mm high. *Corm* 10–18 mm in diameter, ovoid, tunics dark, layers imbricate, notched below into segments. *Cataphyll* membranous, apparently solitary. *Leaves* 3–4, lower basal, uppermost basal or inserted shortly above ground and sheathing lower part of stem, often dry or broken above, margins hyaline, usually slightly raised, (3–)5–9 mm wide. *Stem* erect, simple or rarely bearing a branch from the base, sometimes with a sheathing bract in upper half. *Spike* lightly flexuose, (1–)2–6-flowered; *bracts* (12–)15–20(–30) mm long, herbaceous, with hyaline margin, inner bract shorter, membranous. *Flower* hypocrateriform, white, often pink to brownish on reverse of outer tepals, opening in evening, sweet-scented.

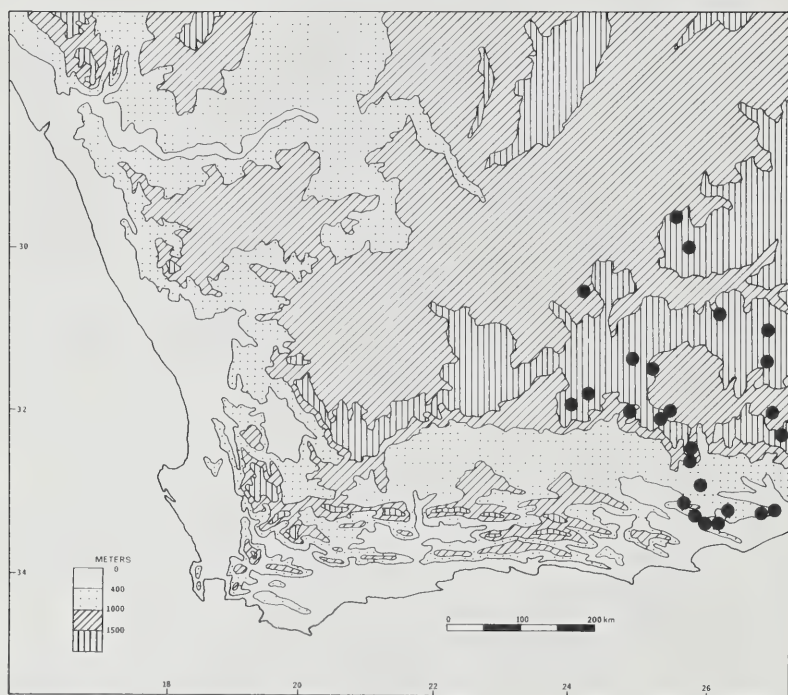


FIG. 15.
Distribution of *Hesperantha longituba*.

perianth tube (10–)12–18 mm long, slightly to well exerted from bracts, straight, cylindrical; *tepals* (15–)20–22 mm long, 8–10 mm wide, ovoid, inner shorter and broader than outer. *Filaments* 5–8 mm long; *anthers* 8–12 mm long, articulated. Ovary 4–5 mm long, style branches to 12–16 mm long. *Capsule* ca. 8 mm long, ovoid. *Chromosome number* unknown.

Flowering time: (mid July–)August–September.

Distribution: higher elevations in the southern and eastern Karoo, extending into the eastern Cape and south western Orange Free State. Fig. 15.

Hesperantha longituba has its centre of distribution in the eastern Karoo mountains around Cradock, Graaff-Reinet, Somerset East and Middelburg, and it is from this area that the most robust specimens have been collected. The lectotype collection from Somerset East (*Bowker s.n.*), consists of plants up to 300 mm tall, with large flowers and a perianth tube 15–18 mm

long. The type collection of *H. candida* var. *bicolor* is from the same area and is clearly conspecific.

Plants from further north and north east towards Queenstown, Aliwal North and the Orange Free State area (including the syntype of *H. longituba*, Cooper 746) seem consistently shorter and have smaller flowers, the bracts in the 15–20 mm range and perianth tube 12–15 mm long. All collections have leaves with clearly raised margins, and the upper parts of the leaves are often dry or broken, possibly from fire scorching or trampling.

A tendency for raised margins, and also broken leaf apices is evident in some specimens from the eastern Karoo as well, e.g. the MacOwan collection (Herb. Norm Aust. Afr. 61) at Zürich, which suggests that the Orange Free State–north eastern Cape plants really do belong here, and that the leaf differences may at least in part be related to climate and season. This somewhat shorter-tubed form links *H. longituba* with the similar and related Transkei, Lesotho and Natal species, *H. vernalis* Hilliard & Burt, which has lilac-coloured flowers and is day-blooming (Hilliard & Burt, 1982; pers. comm.), in contrast to the white-flowered and evening-blooming *H. longituba*.

Several collections from the eastern Cape also match *Hesperantha longituba* well, notably Archibald 5552 and Rogers 2223 from near Paterson, and Rogers 3586 from Alicedale. Other eastern Cape collections cited below as belonging to *H. longituba* consist of depauperate specimens with short leaves and solitary flowered spikes, the most striking example of which is Schönland 361 from the Grahamstown flats. It is unlikely that these dwarfed plants constitute a distinct species, nor are they referable to any other known species. Similar dwarfed and single-flowered plants form part of the gathering made by Ecklon and Zeyher (*Irid.* 220) near the Orange River, which also comprises more typical, larger, several-flowered plants.

Foster (1948) included in his treatment of *Hesperantha longituba* the synonym *Acidanthera huttonii* Baker. This is a pink-flowered species of *Hesperantha* of damp cliffs and slopes and it blooms in autumn (January–April). It extends from Katberg in the eastern Cape to the Transvaal and is clearly distinct from *H. longituba*.

Hesperantha longituba has a large somewhat globose corm in which the older tunic layers tend to accumulate to an unusual extent. The tunics are clearly imbricate in the few collections where corms are well preserved (Brynard 80, Corbitt s.n.) and resemble those of *H. cucullata*. The species is accordingly assigned to section *Imbricata* where it is placed first in the sequence of species. It may be a link between section *Imbricata* and section *Concentrica*. Its closest relative may be *H. cucullata*, from the western Karoo, but it also has similarities with several eastern South African species.

SOUTH AFRICA, ORANGE FREE STATE—2926 (Bloemfontein): Bloemfontein (-AA), *Corbitt s.n.* (NBG 60244); Dolerite hillside, Bloemfontein, *Corbitt s.n.* (NBG 60243); Moscos, 10 km from Dewetsdorp on Reddersburg road (-DA), *Muller 1391* (PRE).

CAPE—3024 (De Aar): Rolfontein Nature Reserve, Petrusville distr. (-BB), *Jooste 260* (PRE).

—3026 (Aliwal North): Ruigtefontein (-DA), *Thode A1868* (K, PRE).

—3124 (Hanover): 13 miles from Naauwpoort, Colesburg Div. (-DB), *Fryer s.n.* (BOL 31522); Compasberg, felsigen Oertern, 5–6000 feet (-DC), *Drège 8470* (G), 8487 (S).

—3125 (Steynsburg): Bangor farm, Middelburg Div. (-AC), *H. Bolus s.n.* (BOL 14049); Middelburg, *H. Bolus 15* (GRA).

—3126 (Queenstown): "Cis-Garipina, vom nördlichen Fuss der Stormbergen bei Buffelsvalei am Garip", 4–5000 feet (-B), *Ecklon & Zeyher Irid. 220* (119.9) (B, G, LD, MO); Buffelsfontein, Wodehouse (-BC), *Stretton 159* (PRE); Finchams Nek, Queenstown (-DD), *Galpin 2487* (K).

—3223 (Rietbron): Near Murraysburg, farm Bloemfontein, 4700 feet (?-BB), *Tyson 303* (K, SAM, Z); Koudeveld Mt., 5000 feet, *Tyson 303* (B).

—3224 (Graaff-Reinet): Graaff-Reinet, clivis montis, 3200 feet (-BC), *H. Bolus 686* (BOL, K, S, SAM); Karoo Nature Reserve, *Linger 2106* (PRE).

—3225 (Somerset East): Mountain Zebra Nat. Park, Cradock (-AB), *Brynard 80* (K, PRE); Cradock (-BA), *Marloth 2152* (PRE); Slopes of the Boschberg (-DA), *MacOwan s.n.* in Herb. Norm. Aust. Afr. 61 (BOL, G, GRA, K, M, US, WU, Z); Waterkloof valley, Somerset East, *Van der Walt 186* (PRE); Somerset East, *Bowker s.n.* (K, S); Near Middleton, Karoo (-DD), *Rogers s.n.* (BOL 12981).

—3227 (Stutterheim): Hogsback, forest edge (-AA), *Batten 4* (NBG); Hogsback, *Giffen s.n.* (PRE); 1.5 miles from railway between Amabele and Kubusie (-DA), *De Vries s.n.* (PRE 36280).

—3325 (Port Elizabeth): Suurberg Pass (-AC), *Bayliss 6049* (MO); 4 miles E of Paterson (-BD), *Archibald 5552* (BOL); Coerney R. valley, 1 mile S of Kromrivier turnoff, *Archibald 5977* (K, PRE); Sandflats (= Paterson), Alexandria Div., *Rogers 2223* (BOL).

—3326 (Grahamstown): Alicedale (-AC), *Cruden 7A* (GRA), *Rogers 3586* (B, K); Howisons Poort (-AD), *Schönland 775* (Z); Grahamstown flats (-BC), *Schönland 361* (Z); Willow Glen farm, Belmont (-BD), *Bayliss 4724* (MO).

Without precise locality: Horncroft, Orange Free State, *Thode A540* (K, PRE); British Kaffraria, *Cooper 1810* (K); Orange Free State, *Cooper 746* (E, G, K, PRE, Z), *Krebs 778 & 780* (B), *Prior s.n.* (K).

13. *Hesperantha cucullata* Klatt, Abh. nat. Ges. Halle 15: 393 (Ergänz. 59) 1882; Baker, Flora Cap. 6: 60. 1896. Type: S. Africa, Hantam Geb., Meyer 9 (B, lectotype, here designated; drawing at S and fragment, perhaps isolectotype, S). Fig. 16.

Hesperantha montana Klatt, Abh. nat. Ges. Halle 15: 393 (Ergänz. 59) 1882; Baker, Flora Cap. 6: 58. 1896. Type: S. Africa, Cape, Hantam Geb., Meyer 21 (B, lectotype, here designated; fragment and isolectotype, S).

Hesperantha buhrii L. Bolus, J. Bot. 69: 13. 1931; Foster, Contr. Gray Herb. 166: 7–8. 1948. Type: S. Africa, Cape, Nieuwoudtville, *Buhr s.n.* ex Hort. Stanford (BOL 18964, lectotype, here designated; GRA, K, isolectotypes).

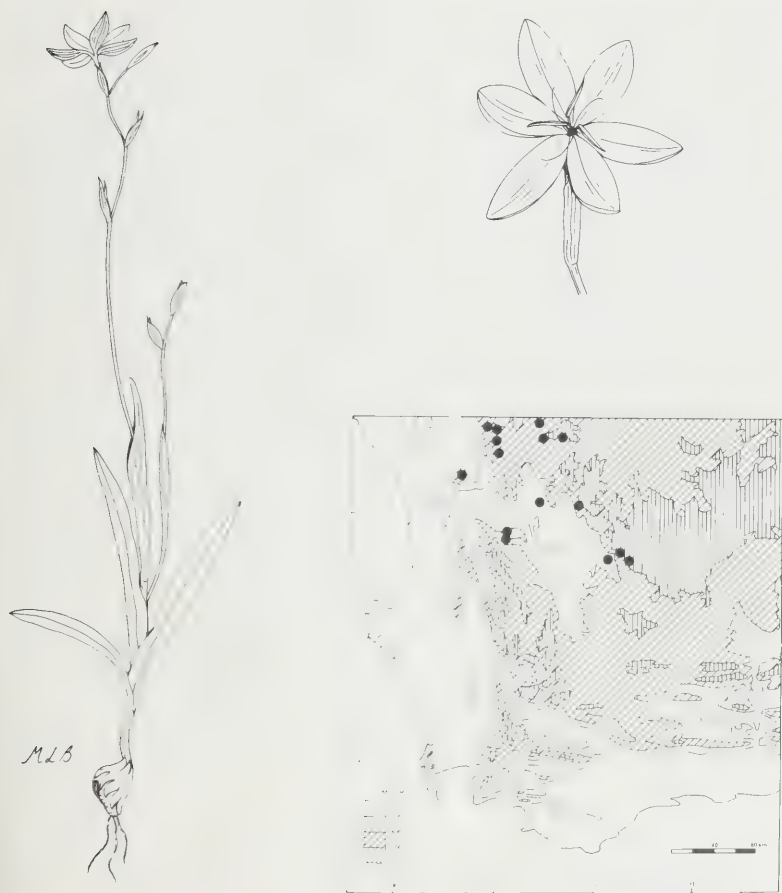


FIG. 16.

Morphology and distribution of *Hesperantha cucullata*. Habit $\times 0.5$; flower life-size (voucher Goldblatt 3954, Nieuwoudtville).

Plants (80–)150–300 mm high. Corm large, to (7–)9–14 mm in diameter, ovoid, asymmetric, with an oblique base, and prominent down-pointed lateral process, tunics imbricate, dark, woody, innermost layer entire, ridged vertically, outer layers regularly V-notched at base, and divided into rectangular segments, often split above into short cusps. Cataphyll soli-

tary, membranous. *Leaves* 3–4, ensiform to falcate, 5–10 mm wide, 70–100 mm long, lower 3 basal, upper basal or inserted above ground, sheathing most, or only lower part of stem. *Stem* erect, simple or branched. *Spike* lightly flexuose, (1–)2–10-flowered; *bracts* 10–12(–15) mm long, membranous, pale green to transparent with green veins, inner about as long as outer. *Flower* hypocrateriform, white, with deep red on reverse of outer tepals, opening towards sunset and then sweet-scented; *perianth tube* 6–9 mm long, reaching to near apex of bracts; *tepals* 15–20 mm long, ovoid, 5–10 mm wide. *Filaments* 3–5 mm long; *anthers* 6–8.5 mm long, articulated and horizontal, pollen white. *Ovary* 2–3 mm long; style branches to 8 mm long. *Capsule* oblong, to 12 mm long, ca. 5 mm in diameter. *Chromosome number* $2n = 26$ (Goldblatt 243 as *H. buhrii*; Goldblatt 3954).

Flowering time: late July–mid September–early October; flowers opening after 16h00, closing 18h00.

Distribution: Calvinia district, especially common around Nieuwoudtville extending from the Hantamsberg south to the Roggeveld Mountains, Doorn River basin and Bidouw. Fig. 16.

After a careful examination of a large number of recent collections of the species long known as *Hesperantha buhrii*, I have reached the conclusion that two poorly-known species, *H. cucullata* and *H. montana*, described in 1882 by Klatt, are almost certainly conspecific with it. The reason for the problem surrounding *H. cucullata* and *H. montana* is the incompleteness of the type collections, and the fact that both types appear to represent dwarf forms, while the type and most collections of *H. buhrii* are robust, and tall. Foster (1948) considered *H. cucullata* and *H. montana* conspecific, uniting the two under the name *H. cucullata*, but he treated *H. buhrii* as distinct, which is understandable as he had only one sheet of this species, the type collection, available to him.

Collections such as that of *L. Bolus s.n.* (Nat. Bot. Gard. 1570/30), *Lewis* 5872, *Goldblatt* 3905 and 5796 comprise a range of plant size from the robust and many-flowered, matching the type of *H. buhrii*, to short and few-flowered forms. These smaller individuals in turn resemble collections of entirely dwarf plants e.g. *Lewis* 2385 and 2636, *Barker* 6544, and it requires little imagination to see these as close matches for *Meyer* 21, the cormless and flowerless type of *H. montana*, and for *Meyer* 9, the slightly larger type specimen of *H. cucullata*, also now lacking a corm. When described, *H. cucullata* had a corm, and a drawing of it at the Stockholm Herbarium matches exactly the large asymmetric corm with imbricate tunics of *H. buhrii*. The discrepancies in the colour of the flower of *H. cucullata* described by Klatt as lilac with a violet tube should be ignored, for Klatt had only dried

material available and the colour of dried flowers often changes, and may not represent the colour of living flowers.

Hesperantha cucullata is best known from the Nieuwoudtville escarpment area, where it is common, but it extends north and east to Calvinia and Loeriesfontein and south east along the Roggeveld escarpment and through the Doorn River basin. Across the Doorn River it grows in the dry eastern valleys of the Cedarberg, such as the Bidouw valley, but westwards it is replaced in similar habitats by *H. falcata*, and the two species are difficult to distinguish except by examination of the corms. Those of *H. cucullata* are large, globose and asymmetric with an oblique flat base and large downward extension, while those of *H. falcata* are usually smaller, and always symmetric, being triangular to campanulate in outline with a flat base.

Populations from the southern end of the Roggeveld clearly represent a distinct race of *Hesperantha cucullata*, but do not differ sufficiently in any morphological feature to warrant taxonomic recognition. These Roggeveld plants grow in very wet situations and although they are usually quite robust, they have only two or three flowers per spike. The flowers are relatively large, with tepals up to 20 mm long, and they have dark brown markings on the reverse of the outer tepals in contrast to the bright red in other parts of the range of this species.

SOUTH AFRICA, CAPE—3118 (Van Rhynsdorp): Top of Gifberg Pass (-DD), *Marsh 520* (STE).

—3119 (Calvinia): Meulsteenvlei, top of Van Rhyns Pass (-AC), *Lewis 5872* (NBG); Nieuwoudtville, *L. Bolus s.n.* (Nat. Bot. Gard. 1570/30 in BOL, GRA, PRE, SAM), *Esterhuysen 5993* (BOL), *Buhr s.n.* (BOL 18964, STE 10770, NBG 60247 & 60248), *Goldblatt 243* (BOL), *Lewis 2284* (SAM), 5852 (NBG), *Barker 9564* (NBG, STE); Klipkoppies, 2 miles NE of Nieuwoudtville, *Nordenstam 2998* (M, S), 763 (S); Glenlyon farm, *Lewis 5876, 5877* (NBG), *Goldblatt 3954* (M, MO, PRE, US, WAG); Grasberg-Nieuwoudtville, *Lewis 5841* (NBG, UC); Oorlogskloof, *Compton 20893* (NBG); Uitkomst farm SW of Nieuwoudtville, *Barker 10749* (K, NBG, STE); 14 km W of Calvinia, on Loeriesfontein road (-BC), *Goldblatt 3938* (MO); Hollerivier, 15 miles NW of Calvinia, *Lewis 2636* (SAM); Loeriesfontein road 15 miles from Calvinia, *Middlemost 1781* (NBG); Western end of Hantamsberg below summit cliffs, *Goldblatt 5790* (MO); Akkerdam, below Hantamsberg, Calvinia (-BD), *Lewis 5812* (NBG); Lokenburg (-CA), *Barker 1478* (BOL, NBG); 15 miles S of Nieuwoudtville, *Lewis 5836* (NBG); 22 miles S of Nieuwoudtville, *Barker 6544* (NBG), *Lewis 2285* (SAM); Driefontein, voor Hantam (-DA), *Marloth 12807* (PRE); 51 km S of Calvinia (-DC), *Goldblatt 3905* (MO); Vondelingsfontein, Roggeveld Mts. (-DD), *Thompson 2479* (STE).

—3219 (Wuppertal): Bidouw Valley (-AA), *Goldblatt 2535* (C, M, MO, NBG, PRE), 6160 (MO); Bidouw Mts., *Compton 7761* (NBG); Mountain slopes above Welbedacht, *Lewis 5223* (M, NBG); Pass into Bidouw valley, *Thompson 338A* (PRE, STE).

—3220 (Sutherland): Geelhoek (Vyffontein), Sutherland distr. (-AB), *Acocks 17184* (K, PRE); Uitkyk farm, Roggeveld (-AC), *Marloth 9718* (PRE), *Goldblatt 6359*

(MO); Between Sneeukskrans and Kromberg, *Oliver 4416* (K, PRE, STE); Voëlfontein farm, NW of Sutherland (-AD), *Goldblatt 6317* (K, MO, NBG, PRE, S, WAG); Fransplaas, *Marloth 9831* (K, PRE); Tuinplaas, Tanqua Karoo (-CD), *Marloth 10373* (PRE).

Without precise locality: Hantams Geb., *Meyer 17* (B), *Meyer 18*, in part (B).

14. *Hesperantha vaginata* (Sweet) Goldbl., Jl S. Afr. Bot. 36: 298. 1970. Fig. 17.

Geissorhiza vaginata Sweet. Br. Fl. Gard. 2: tab. 138. 1826; Baker, Flora Cap. 6: 73. 1896 in synonym. sub *G. inflexa* (de la Roche) Ker. Type: illustration in Br. Fl. Gard. 2: tab. 138.

Hesperantha metelercampiae L.Bolus, Ann. Bolus Herb. 4: 114. 1927. Type: South Africa, Cape, near Nieuwoudtville, *Metelercamp s.n.* (BOL 18555, holotype).

Hesperantha stanfordiae L.Bolus, S. African Gard. 21: 281–282. 1931. Type: South Africa, Cape, near Nieuwoudtville, *Buhr s.n.* ex Hort. K. Stanford (BOL 19880, lectotype; K, S, isoelectotypes). (Description suggests two type specimens, but sheet at BOL is all one gathering.)

Hesperantha inflexa (de la Roche) Foster, sensu Foster, Contr. Gray Herb. 135: 77. 1941 (= *Geissorhiza inflexa* (de la Roche) Goldbl.) (see Goldblatt & Barnard, 1970).

Plants 120–180 mm high. *Corm* asymmetric, globose with one end obliquely flattened and with a well-developed foot projection, tunics imbricate, dark, woody, the layers split and notched into segments below. *Cataphyll* solitary. *Leaves* usually 4 or 5, basal, or upper inserted in lower part of stem, 8–10 mm wide, falcate, obtuse, 50–90 mm long, uppermost leaf sheathing the lower half of stem, but with free apex. *Stem* erect, single, or 2–3, branched from base. *Spike* weakly flexuose, (1–)2–4-flowered; *bracts* membranous, or pale green when young, 20–25 mm long, inner smaller, by several millimetres, two-veined, and bifurcate. *Flower* large, infundibuliform, clear yellow, or dark brown-black in throat and in upper half (or apices) of tepals, opening ca. 15h00; *perianth tube* 5–8 mm long, narrow at base, widening gradually to throat; *tepals* subequal, 30–35 mm long, lanceolate, 15–17 mm at widest point. *Filaments* ca. 3 mm long; *anthers* (11–)12–15 mm long. *Ovary* ca. 3 mm long, style branches ca. 5 mm long. *Capsule* 9–10 mm long, obovoid. *Chromosome number* $2n = 26$ (Goldblatt 93; 259, both as *H. stanfordiae*; 6229).

Flowering time: mid-August–September; flowers opening ca. 15h00, closing about 18h30.

Distribution: western Karoo in the Calvinia district, especially common in the vicinity of Nieuwoudtville but local at Kareeboomfontein, SW of



FIG. 17.
Morphology of *Hesperantha vaginata* and distribution of *H. vaginata* and *H. karooica*. Habit $\times 0,5$; flower and corm life-size; tepal and gynoecium $\times 2$ (voucher Goldblatt 4035, Nieuwoudtville).

Calvinia and Paardekraal NW of Calvinia, usually on heavy clay soils. Fig. 17.

Hesperantha vaginata is a well-known, and striking member of the spring flora of the the Nieuwoudtville area where it was, until recently, believed to be endemic. Recent collections from Kareeboomfontein SW of Calvinia (Hanekom 2385) and by Goldblatt from Paardekraal, north of the Hantamsberg (Goldblatt 6229), represent significant range extensions. There are two colour forms, a clear yellow, which has been named *H. stanfordia* and one

with contrasting dark brown to black markings (Fig. 17). The yellow form, which is now rare, if not extinct, grew immediately around Nieuwoudtville village, while the bicoloured form extends several miles to the north and south of the town where it is found mainly in heavy red clay soil, as well as the localities mentioned above. Near Oorlogskloof farm some miles south I have seen a population in which self- and bicoloured plants grew together. There seems little reason for giving taxonomic recognition to the yellow-flowered plants, which seem to be no more than colour variants.

This species has had a more complex taxonomic history than one would expect from so distinct a plant. It was first described by Sweet in 1826 as *Geissorhiza vaginata*. Subsequently, *Ixia inflexa* de la Roche (1766) was thought to be conspecific and in *Flora Capensis*, *G. vaginata* is treated as a synonym of *Geissorhiza inflexa* by Baker (1896). L. Bolus, working in South Africa, rediscovered the species in the late 1920's and correctly placed it in *Hesperantha*. Thinking the species new, she named the bicoloured form *H. metelerkampiae* and the self-coloured, *H. stanfordiae*. Foster (1941) realised that *Geissorhiza inflexa* sensu Baker was a species of *Hesperantha* and, considering *Ixia inflexa* the earliest name for the species, made the combination *H. inflexa*. He regarded *H. metelerkampiae* as a synonym, and *H. stanfordiae* a variety. This situation continued until 1970 when a collection of specimens from the Leiden Herbarium came to my attention, and proved to contain types and authentic specimens studied by Daniel de la Roche, who had originally described *Ixia inflexa* (Goldblatt & Barnard, 1970). The type material was clearly not a *Hesperantha*, but conspecific with a species of *Geissorhiza* then known as *G. quinquangularis*. Thus, *G. vaginata* was found to be the earliest name for the species, and accordingly the combination in *Hesperantha* was made. Thus developed the unfortunate situation where a fairly well-known species had four different specific names in a 50 year period.

Hesperantha vaginata has no obvious relatives and is a typical, though unusually large-flowered member of the genus. A possible close ally may be *H. karooica*, a smaller, yellow-flowered species from the flats below the Hantamsberg.

SOUTH AFRICA, CAPÈ—3119 (Calvinia): Nieuwoudtville (-AC), *Buhr s.n.* (STE 17317), *Buhr s.n.* (NBG 60255), *Metelerkamp s.n.* (BOL 18555), (NBG 60257, ex hort. *Metelerkamp*), *Buhr s.n.* ex hort. *Stanford* (BOL 19880, K), *Goldblatt* 93 (J); 1 mile S of Nieuwoudtville, *Goldblatt* 448 (BOL); Glenlyon farm, *Hardy* 72 (K, M, NBG, PRE), *Goldblatt* 4035 (E, MO, PRE, US), 259 (BOL), *Oliver & Mauve* 57 (STE); 2 miles N of Nieuwoudtville, *Hardy* 78 (NBG, PRE); Klip Koppies N of Nieuwoudtville, *Lewis* 5857 (M, MO, NBG, S, UC), *L. Bolus s.n.* (BOL 19440, K), *Nordenstam* 1925 (S); Oorlogskloof farm, S of Nieuwoudtville, *Goldblatt* 352 (BOL); Paardekraal farm, 40 km NW of Calvinia, deep red clay (-BC), *Goldblatt* 6229 (EA,

K, MO, NBG, PRE, S, US, WAG); Kareeboomfontein, Calvinia, west of Rebuie (-DA), Hanekom 2385 (MO).

Without precise locality: Hantams Geb., Meyer 1 (B).

15. *Hesperantha karoocica* Goldbl., sp. nov.

Plantae 30–50 mm altae; *cormo* 8–12 mm in diametro, globoso, tunicis imbricatis, *foliis* 3–4, basalibus, 3–4 mm latis, *spicis* 1–2 floribus, *bracteis* 12–15 mm longis, *floribus* stellatis, *tubo perianthii* ca. 5 mm longo, *tepals* ca. 20 mm longis, *filamentis* ca. 3 mm longis, *antheris* 9 mm longis.

Type: S. Africa, Cape, Calvinia commonage, Stayner s.n. (NBG 87606, holotype; STE 31028, isotype).

Plants small, 30–50 mm high. *Corm* asymmetric, elongate-globose with an oblique flat side and prominent downward projection; tunics blackish, imbricate, woody, several-layered, outer rather broken, deeply and irregularly notched below, drawn into bristles above. *Cataphyll* solitary, membranous. *Leaves* 3–4, basal, falcate, ca. 30 mm long, 3–4 mm wide, obtuse to subacute, uppermost leaf sheathing most of the stem. *Stem* 10–20 mm long, solitary or 1–2, branched from the base. *Spike* 1–2-flowered, not flexed; *bracts* pale green, subherbaceous, 12–15 mm long, inner about as long as outer, much narrower, submembranous. *Flower* yellow, stellate, outer *tepals* purplish on reverse; *perianth tube* ca. 5 mm long, enclosed in bracts; *tepals* ca. 20 mm long, lanceolate, outer ca. 9 mm wide, inner 7 mm wide. *Filaments* ca. 3 mm; *anthers* 9 mm long. *Ovary* 2.5–3 mm, style branches ca. 9 mm long. *Capsule* and seeds unknown. *Chromosome number* unknown.

Flowering time: August.

Distribution: known only from the commonage at Calvinia in the western Karoo, at the foot of the Hantamsberg. Fig. 17.

This rare species, known from only two collections, is apparently related to *Hesperantha vaginata* which also occurs in the Calvinia district. The latter is very common in the Nieuwoudtville area 70 km to the west, but is also found near Driefontein S of Calvinia and at Paardekraal to the north west.

Its large, globose, asymmetric corm with overlapping tunics places *H. karoocica* clearly in section *Imbricata*. It shows a strong tendency for reduction of the aerial stem, and is probably close to the line leading to the acaulescent species of the section, *H. humilis*, *H. flava*, and *H. hantamensis* in which the aerial part of the stem is reduced and the flowers have a correspondingly long perianth tube to raise the flower above ground.

Hesperantha karoocica probably flowers irregularly from year to year,

otherwise it would certainly have been collected more often in the comparatively well-botanised area around Calvinia.

SOUTH AFRICA, CAPE—3119 (Calvinia): Commonage at Calvinia (-BD), *Stayner s.n.* (NBG 87606, STE 31028); Akkerdam, foot of Hamtamsberg, *Lewis 5810* (mixed collection with *H. bachmannii*) (S).

16. *Hesperantha humilis* Baker, J. Bot. **14**: 239. 1876 et Flora Cap. **6**: 62. 1896; Foster, Contr. Gray Herb. **166**: 16. 1948. Type: S. Africa, Cape, Roggeveld near Jakhalsfontein, *Burchell 1320* (K, holotype). **Fig. 18.**

Plants small, 30–70 mm high with aerial stem usually lacking, rarely very short. *Corm* large, 12–16 mm in diameter, more or less globose, with an oblique flat side, tunics imbricate, blackish, usually with several layers superimposed, outer much broken, all fairly regularly V-notched below, drawn into points apically. *Cataphyll* evidently lacking or solitary, membranous, dry and brownish above ground. *Leaves* (2–)3, basal, falcate, comparatively broad, 20–70 mm long, 6–8 mm wide, obtuse. *Stem* usually entirely underground, occasionally just emerging (rarely up to 80 mm long), single or occasionally 2. *Spike* 1–2(–3)-flowered; *bracts* dimorphic, outer large, leaf-like, green, 20–30 mm long, carinate, inner bract entirely enclosed, smaller, membranous. *Flower* hypocrateriform, pink, or rose with a dark throat (when dry, inner tepals pale); *perianth tube* 17–24 mm long, initially as long as the bract, but later somewhat longer; *tepals* 17–25 mm long, subequal, ovoid, 8–11 mm wide. *Filaments* 3–4 mm long; *anthers* 4.5–8 mm, articulated. Ovary 3 mm, style branches to 12 mm. *Capsule* large, oblong, 15–20 mm long. *Chromosome number* $2n = 26$ (*Goldblatt s.n.*, no voucher – Matroosberg Station; 6341).

Flowering time: July–August(–September at high altitudes); flowers open in early morning, and close an hour before dark.

Distribution: east of Hex River Pass to Whitehill, the Klein Roggeveld and Roggeveld, extending north to the Hantamsberg at Calvinia; mainly clay flats and slopes, but also on sandy soils derived from Cape sandstone. **Fig. 18.**

Hesperantha humilis is relatively common in the high-lying country east of the Hex River Pass, despite the few collections for so large an area suggesting the contrary. It extends east of the Pass and north of the Witteberg Mountains as far as Whitehill, northwards in the Klein Roggeveld, and along the Roggeveld escarpment to Sneeukskrans. There is a single collection (*Marloth 10459*) from the Hantamsberg, over 100 km to the north. Plants



FIG. 18.

Morphology and distribution of *Hesperantha humilis*. Habit $\times 0,5$; flower life-size (voucher van Zyl s.n. no voucher, Roggeveld).

from the Sutherland area are generally more robust and have slightly larger flowers of a reddish colour but these differences do not seem to warrant taxonomic recognition. *Hesperantha humilis* is closely related to *H. hantamensis*, another dwarf species, known only from the flats below the Hantamsberg at Calvinia. The two share a similar habit, with flowers borne at or close to ground level, and identical large herbaceous bracts. *Hesperantha hantamensis* has white flowers with smaller tepals than *H. humilis* and the two are easily distinguished. Also related is the poorly-collected *H. flava*, a yellow-flowered species, very similar in general appearance to *H. humilis*. Apart from colour and small differences in flower size, and the fact that *H. flava* consistently has only two basal leaves, there is nothing to distinguish these two species morphologically. However, while *H. humilis* is a day-blooming species, with flowers closing around 17h00, flowers of *H. flava* only open at about this time, and remain open most of the night, closing only a few hours before dawn.

SOUTH AFRICA, CAPE—3119 (Calvinia): Renosterhoek, Hantam Mts. (-BD), Marloth 10459 (B, PRE).

—3220 (Sutherland): Quaggasfontein, NW of Sutherland, near Uitkyk (-AB), Goldblatt 6354 (MO); Sneeukskrans Mt., S of Voëlfontein farm house, 4500 ft (-AD), Goldblatt 6341 (MO); Voëlfontein, Sutherland distr., Hall 3250 (NBG); Flats SW of Swaarweeberg, Sutherland (-BC), Thompson 1774 (K, STE); Top of Verlaten

Kloof, S of Sutherland (-DA), *Goldblatt* 580 (BOL); Waterkloof near Sutherland, *Marloth* 9677 (PRE); Towards Waterkloof, *Marloth* 10403 (B, PRE); Roggeveld near Jakhalsfontein, *Burchell* 1320 (K); Klein Roggeveld (-D), *Compton* 7278 (NBG).

—3319 (Worcester): 15 miles N of Koo, 3500 feet (-DB), *Stayner s.n.* (NBG 62763).
—3320 (Montagu): Whitehill, 3000 feet (-BA), *Adamson s.n.* (BOL); Whitehill ridge, *Compton* 4274 (BOL, K, NBG); 2 miles W of Matjiesfontein, *Goldblatt* 658 (BOL); Matjiesfontein, stony clay, *Hall* 2237 (NBG); Lower slopes of the Witteberg above Bantams on FM tower road, *Goldblatt* 3776, (K, MO, PRE, S).

17. *Hesperantha flava* Lewis, S. African Gard. **23**: 255. 1933; Foster, Contr. Gray Herb. **166**: 12. 1948. Type: S. Africa, Cape, Whitehill, *Compton* 4276 (BOL, lectotype here designated; K, isolectotype). **Fig. 19.**

Plants small, 40–60 mm high, including flowers, with aerial stem very short or lacking. *Corm* (as in *H. humilis*) comparatively large, to 15 mm in diameter, globose, strongly asymmetric, with one side flattened, and a prominent downward projection, tunics imbricate, dark, outer breaking into vertical segments that are drawn into bristles above. *Cataphyll* solitary, membranous. *Leaves* two (rarely with a third very small one), basal, unequal, lower 25–40 mm long, upper 10–20 mm long, fairly broad, 4–10 mm wide, obtuse, oblong-falcate. *Stem* entirely underground, or up to 12 mm



FIG. 19.

Morphology and distribution of *Hesperantha flava*. Habit $\times 0.5$; flower life-size (voucher *Goldblatt* 6074, Ghaap Kop, Matjiesfontein).

above ground, simple, sometimes bearing a short narrow bract-like leaf below the bracts. *Spike* 1–2-flowered; *bracts* 15–20 mm long, outer herbaceous, evidently truncate, or obtuse, inner bract enclosed, membranous, but as long. *Flower* hypocrateriform, yellow, outer tepals dark brown on reverse; *perianth tube* cylindric, 18–28 mm long, initially shortly emerging from bracts, later to 12 mm longer; *tepals* unequal, outer 13–15 mm long, 5–8 mm wide, obovate, inner 1–2 mm shorter. *Filaments* ca. 3.5 mm long; *anthers* 5–7 mm. *Ovary* 4–5 mm, style branches 4–8 mm. *Capsule* oblong, 15–25 mm long. *Chromosome number* $2n = 26$ (Goldblatt 5760; 6074).

Flowering time: July–August; flowers opening at about 17h00 and closing a few hours before dawn.

Distribution: known only from the foot of the Witteberg between Matjiesfontein and Whitehill in the western Karoo, and around Steinkopf, northern Namaqualand, in stony soils of decomposing shale. Fig. 19.

Hesperantha flava is a rare night-blooming species closely related to the fairly widespread and common, pink-flowered *H. humilis*. The two are very similar morphologically, having a stemless growth habit, with broad, falcate, basal leaves, and large, conspicuous, herbaceous floral bracts. *H. flava* typically has only two, very unequal leaves, and *H. humilis* usually has three, the lower two similar in size. In addition to leaf number, and flower colour, the species differ in flower phenology. *H. humilis* is day-blooming, with flowers open from early morning until about 17h00, while *H. flava* is night-blooming. Its flowers open between 16h00 and 17h00 and close a few hours before dawn. These two species are so similar that they must have diverged recently, and in response to the habits of different pollinating insects. Visitors to *H. humilis* have not yet been recorded but Vogel (1954) reports that *H. flava* is visited, and presumably pollinated, by hawk moths.

Hesperantha flava has a peculiar distribution. It is known from the western Karoo at the foot of the Witteberg in the Matjiesfontein–Whitehill area, and on localised shale outcrops over 450 km to the north, near Steinkopf in Namaqualand. The Steinkopf locality was first reported by Vogel (1954), but only in the literature and populations in this area were rediscovered in 1970 by myself. There are no similar distribution patterns in Iridaceae, in which disjunct ranges of this size are rare among species in southern Africa.

SOUTH AFRICA, CAPE—2917 (Springbok): Slope 1 mile W of Steinkopf (BD), Goldblatt 680 (BOL); 4 km W of Steinkopf. Goldblatt 5750 (MO), 6003 (MO, NBG).

—3320 (Montagu): Whitehill (-BA), Compton 4276 (BOL, K); W slope at foot of Ghaap Kop, near Matjiesfontein, Goldblatt 6074 (MO, NBG), 6373A (MO).

18. *Hesperantha hantamensis* Schltr. ex Foster, Contr. Gray Herb. 166: 15. 1948. Type: S. Africa, Cape, Calvinia, dolerite hills, 1 000 m, Marloth 10262 (B, holotype; PRE, STE, isotypes). Fig. 20.

Plants small, stem subterranean or very shortly produced above ground. *Corm* 12–15 mm in diameter, asymmetrical, more or less conic, with an oblique flat side; tunics imbricate, blackish, usually with several concentric layers lying on one another, outer much broken, all fairly regularly V-notched below and often drawn above into stiff bristles. *Cataphyll* solitary, membranous, evidently dry and brownish above ground. *Leaves* 3–4, basal, falcate, comparatively broad, 20–40 mm long, 5–6 mm wide, obtuse. *Stem* usually underground or extending above ground for up to 60 mm, simple or with a single basal branch. *Spike* 1–3-flowered, *bracts* dimorphic, outer large, leaf-like, green, 15–25 mm long, carinate, inner bract entirely enclosed, smaller, membranous. *Flower* hypocrateriform, white with purple on reverse of outer tepals; *perianth tube* 14–20 mm long, initially slightly longer than the bracts, but becoming longer; *tepals* 8–12 mm long, ovoid, 4–5 mm wide, inner slightly smaller. *Filaments* ca. 3–5 mm long; *anthers* 5–6 mm, articulated. *Ovary* 2–3 mm, style branches to 9 mm long. *Capsule* oblong, ca. 12 mm long. *Chromosome number* unknown.



FIG. 20.
Morphology and distribution of *Hesperantha hantamensis*. Habit $\times 0,5$; flower life-size (voucher Goldblatt 6065, Hantamsberg flats).

Flowering time: July(–early August); flowers opening 13h00–14h00, and closing in early evening.

Distribution: known only from the flats at the foot of the Hantamsberg near Calvinia. Fig. 20.

This species has been collected infrequently and is consequently poorly known. It may not be as rare as the record suggests, but has probably been overlooked because of its small size and short flowering period. It is related to *Hesperantha humilis* which extends from the Hantamsberg southwards, and has a larger pink or red flower, but is otherwise very similar in habit, and vegetative morphology. Both species usually have a stem that is entirely underground, or only shortly produced above ground. The white flowers of *H. hantamensis* have tepals in the 8–12 mm long range while those of *H. humilis* are 17–20 and even up to 24 mm in length. The yellow-flowered *H. flava* is allied to these two species, being similar in general morphology, but usually having only two leaves and a single yellow flower on each plant. This group of three species is probably allied to *H. vaginata* and *H. karooica* and more generally to *H. cucullata*, all of which have similar corms. The other dwarf and sessile, or very short-stemmed species of the winter rainfall area, *H. latifolia* and *H. luticola*, appear unrelated, having very different corm and bract morphology.

SOUTH AFRICA, CAPE—3119 (Calvinia): Foot of the Hantamsberg, near Calvinia (-BD), *Lewis 5811* (NBG), *Goldblatt 280* (BOL), 6065 (MO, NBG); Hantams Geb., *Meyer 18* (B); Calvinia, northern dolerite hills, *Marloth 10262* (B, PRE, STE).

19. *Hesperantha purpurea* Goldbl., sp. nov. Fig. 21.

Plantae 80–250 mm altae, *cormo* 8–12 mm in diametro, globoso, tunicis imbricatis, *foliis* 4–5, basalibus, 7–10 mm latis, *spicis* 1–3 floribus, *bracteis* 15–20 mm longis, acutis, *floribus* hypocrateriformibus, purpureis, atomaculatis ad basem tepalorum, *tubo perianthii* ca. 20 mm longo, *tepalis* 16–20 mm longis, *filamentis* brevibus, 1,5–2 mm longis, *antheris* 5–6 mm longis.

Type: S. Africa, Cape, Paardekraal farm NW of Calvinia, *Goldblatt 6246* (MO, holotype; K, NBG, PRE, S, isotypes).

Plants 80–250 mm high. *Corm* ± globose with an oblique flat side, 8–12 mm in diameter, tunics black, hard, imbricate, notched below and above. *Cataphyll* evidently single, membranous, below ground. *Leaves* 4–5, all basal, erect to strongly falcate, the lower obtuse, 30–70 mm long, 7–10 mm wide. *Stem* short to long, simple or branching from near base, up to 15 mm above ground, sometimes concealed by leaf bases. *Spike* 1–3-flowered; *bracts* green, 15–20 mm long, inner slightly shorter than outer. *Flower* ±

hypocrateriform, long-tubed, reddish-purple with dark marking at base of each tepal, and white in the throat and tube, open during the day; *perianth tube* ca. 20 mm long, widening near apex; *tepals* 16–20 mm long, 5–7 mm wide, oblanceolate. *Filaments* 1.5–2 mm long; *anthers* 5–6 mm long. *Ovary* 3–4 mm long, style branches 10–14 mm long. *Capsule* ovoid, 10–14 mm long. *Chromosome number* $2n = 26$ (also 39) (Goldblatt 6246).

Flowering time: August–September.

Distribution: known only from the hills and flats north of the Hantamsberg, on clay soils on moister S-facing slopes. Fig. 21.

Hesperantha purpurea is known only from the type gathering which I made in 1981. It is probably fairly restricted in its range, but the area where it was discovered north of the Hantamsberg is poorly known botanically and *H. purpurea* may be more common in this general area than the present record indicates. The only known population was found on the moister, S-facing slope of a rocky hill on the farm Paardekraal, growing in heavy clay soil. I am indebted to Mr. B. Visagie for the discovery of *H. purpurea*, which was found while accompanying him on a tour of his farm.

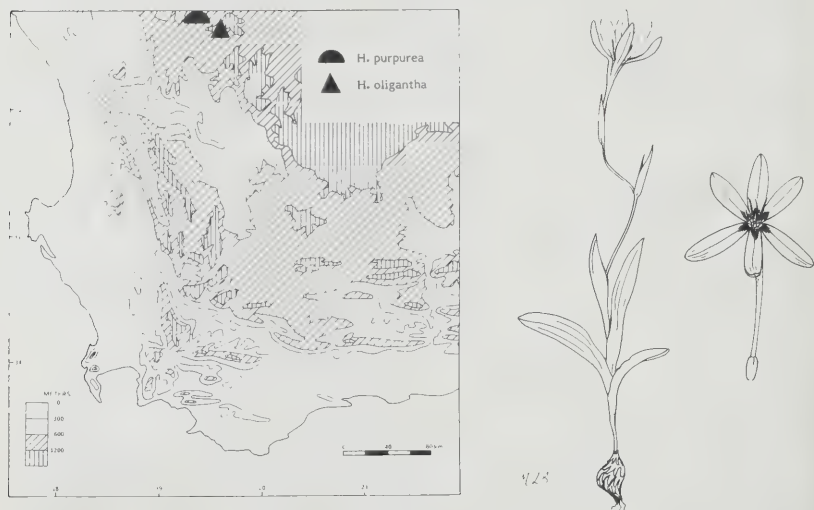


FIG. 21.

Morphology of *Hesperantha purpurea* and distribution of *H. purpurea* and *H. oligantha*. Habit $\times 0.5$; flower life-size (voucher Goldblatt 6246, Paardekraal, NW of Calvinia).

The large subglobose corm with imbricate tunics is typical of section *Imbricata*, which is centred in the western Karoo. *Hesperantha purpurea* is thus one more example of the radiation that has taken place in *Hesperantha* along the border of the western Karoo and Cape Region. The species is distinct in the section in its bright purple flower colour with dark markings at the bases of the tepals, and in its long perianth tube. It is probably closely related to the poorly-known *H. oligantha* which has been collected only once, in 1900 on the Hantamsberg, a short distance to the south east. *Hesperantha purpurea* is very variable in plant size and leaf development, depending on the amount of shading and moisture available, but even the smallest specimens collected, ca. 8 mm high, seem more robust, and have much broader, and shorter, leaves than the very dwarf *H. oligantha* which stands 6–8 mm high including the flowers, and has long narrow leaves 2–3 mm wide. The flowers also differ, although those of both species are purple. *Hesperantha purpurea* has a perianth tube ca. 20 mm long, exerted a short distance from the soft textured, acute bracts usually ± 15 mm long; fairly large corms 8–12 mm in diameter; and unusually short stamens with filaments 1.5–2 mm long. In contrast, *H. oligantha* has a longer perianth tube 25–35 mm long, well exerted from firm, obtuse bracts 15–20 mm long; small corms evidently only 4–5 mm in diameter; and long stamens with filaments up to 10 mm long. There seems good reason to regard these two species as related, but they are clearly quite distinct.

SOUTH AFRICA, CAPE—3119 (Calvinia): Paardekraal farm NW of Calvinia, S side of rocky hill (-BC), *Goldblatt* 6246 (K, MO, NBG, PRE, S).

20. *Hesperantha oligantha* (Diels) Goldbl., Contrib. Bol. Herb. 4: 91. 1972.

Lapeirousia oligantha Diels, Bot. Jahrb. 44: 117. 1910. Type: S. Africa, Cape, Hantamsberg, Calvinia, *Diels* 735 (B, holotype; MO, isotype).

Plants small, 60–80 mm high, including flowers. *Corm* globose-elongate, with an oblique flat side, 4–5 mm in diameter, tunics black, apparently imbricate, notched below and above. *Cataphyll* evidently single, membranous, below ground. *Leaves* 3 or 4, all basal, weakly to strongly falcate, 30–70 mm long, 2–3 mm wide. *Stem* short, simple, rarely more than 10 mm above ground, sometimes underground or concealed by leaf bases. *Spike* 2(–3)-flowered; *bracts* green, well-developed, 15–23(–30) mm long, inner entirely enclosed in outer, and shorter. *Flower* evidently infundibuliform, long-tubed, purple; *perianth tube* 25–35 mm long, slender, widening near apex; *tepals* 15–18 mm long, ca. 3 mm wide, oblanceolate. *Filaments* to 10 mm

long; *anthers* 5 mm long. Ovary ca. 4 mm long, style branches ca. 10 mm long. *Capsule* and seeds unknown. *Chromosome number* unknown.

Flowering time: September.

Distribution: known only from the western end of the Hantamsberg at Calvinia; on moist S-facing slopes at 1 300 m. Fig. 21.

Hesperantha oligantha is known only from the single collection made by Diels in 1900. It is clearly rare, for the locality where it was found has been visited regularly by botanists and it has not been recollected. It is evidently restricted to a small part of the Hantamsberg, on damp S-facing slopes.

The relationships of *Hesperantha oligantha* are uncertain as the corm tunics on the type collection are incomplete. The fragmentary material present suggests that the tunics were imbricate and of the kind found in species of section *Imbricata*, but the corms are small for the section. They correspond in size with those of *H. bachmannii* and *H. pallescens* and, while its affinities may lie with these two species rather than with the larger cormed members of the section, it shows certain resemblances with the recently discovered *H. purpurea*. The similarities include unusually long perianth tube and purple flower colour. The differences between the two species are discussed under *H. purpurea*.

SOUTH AFRICA, CAPE—3119 (Calvinia): Western end of the Hantamsberg, moist S slopes at 1 300 m (-BC), *Diels* 735 (B, MO).

21. *Hesperantha pallescens* Goldbl., sp. nov. Fig. 22.

Plantae 100–200 mm altae, *cormo* 3–6 mm in diametro, globoso, tunicis imbricatis, *foliis* 4–5 ± basalibus, 1–3 mm latis, *spicis* 1–4 floribus, *bracteis* 12–16 mm longis, acutis, *floribus* infundibuliformibus, pallidis flavis, *tubo perianthii* 12–20 mm longo, *tepalis* 15–16 mm longis, *filamentis* 5 mm longis, *antheris* 5–6 mm longis.

Type: S. Africa, Cape, near The Rest, below Piekeniers Kloof Pass, S side, *Goldblatt* 5645 (MO, holotype; B, BOL, C, K, M, NBG, P, PRE, S, US, WAG, isotypes).

Plants small to medium, 100–200 mm high. *Corm* small, globose, asymmetric, 3–6 mm in diameter, flattened at one end and with an obscure down-pointed projection, tunics brown, outer layers imbricate, much broken, and notched below, inner entire or beginning to split below, bearing many cormlets on short runners produced from flat side. *Cataphyll* dry, brown, often broken or lost. *Leaves* 4–5, narrow, linear, slightly falcate, 1–3 mm wide, all basal or upper inserted on stem above ground, and partly sheathing. *Stem*

usually straight, simple or 1-2-branched, branches produced from aerial nodes. *Spikes* (1-)2-4-flowered; *bracts* 12-16 mm long, pale green with membranous margins, acute, inner bracts smaller and slightly shorter. *Flower* pale yellow, infundibuliform, actinomorphic, flowers opening after 12h30; *perianth tube* initially exserted 2-3 mm from bracts, later much exserted, 12-20 mm long, slender, widening somewhat near apex; *tepals* cupped, 15-16 mm long, lanceolate, subequal, ca. 5,5 mm at widest point, inner slightly narrower. *Filaments* 5 mm long, inserted at top of tube, con-



FIG. 22.

Morphology and distribution of *Hesperantha pallescens*. Habit and corm $\times 0,5$; flower life-size; gynoecium and opened flower $\times 1,5$ (voucher Goldblatt 5645, below Pickeniers Kloof Pass).

nate; *anthers* 5–6 mm, diverging from base. Ovary ca. 3 mm long, style branches spreading to pendent. *Capsule* obovate, ca. 10 mm long. *Chromosome number* $2n = 26$ (Goldblatt 5645).

Flowering time: August–mid September; flower opening 12h00–13h00, closing near sunset.

Distribution: clayey lower SW slopes of the Olifants River Mountains, evidently very local. Fig. 22.

Hesperantha pallescens is known from only a small area of the south western Cape, and appears to be one more of the very local endemic species of this floristically rich area. It is distinctive in having a very long perianth tube, and pale yellow-cream, actinomorphic flower. It has a small subglobose corm with imbricate tunics regularly notched below, and bearing many very small cormlets around the base. In both size and appearance, the corm resembles that found in the widespread *H. bachmannii* and it is to this species that *H. pallescens* is probably most closely allied. The flowers of *H. bachmannii* are very different, having a short, curved perianth tube and pendulous anthers, so that there is no possibility of confusing the two species. The flowers of *H. pallescens* open shortly after noon and close towards evening at about 17h30, at about the same time that the flowers of *H. falcata*, which is sympatric, begin to open. Despite its fairly large, attractive flowers, *H. pallescens* has been found to be strongly autogamous in the greenhouse. This is unusual, and in its native habitat it is probably regularly visited by pollinating insects.

SOUTH AFRICA, CAPE—3218 (Clanwilliam): Near The Rest, below Piekerniers Kloof Pass (-DB), Goldblatt 5645 (B, BOL, C, K, M, MO, NBG, P, PRE, S, US, WAG); The Rest, Gillett 3712 (BOL, K, STE).

22. *Hesperantha bachmannii* Baker, Bull. Herb. Boiss. ser. 2, 1: 863. 1901; Foster, Contr. Gray Herb. 166: 4. 1948. Type: S. Africa, Cape, near Hopefield, *Bachmann 1177* (G, lectotype designated by Foster (1948); B, Z, isolectotypes). Fig. 23.

Hesperantha virginea Ker. König & Sims Ann. Bot. 1: 225. 1805 nomen nudum.

Hesperantha angusta (Jacq.) Ker, sensu Baker, Handbk. Irid. 152. 1892 & Flora Cap. 6: 65. 1896

Plants 150–300 mm high. *Corm* globose, to 10 mm long and 6–8 mm at widest, base oblique, with a small downward projection, and often bearing several small bulbils round the base; tunics dark brown, woody, entire above, notched below into segments, with tunics of previous years smaller,

and accumulated in overlapping layers above. *Cataphylls* dry, membranous, 1–2. *Leaves* 3–4, linear to slightly falcate, flat, very thin-textured, about half as long as the plant, 2–7 mm wide, uppermost sheathing lower half of stem. *Stem* erect, sometimes with 1–2 branches produced from near the base, occasionally also from an upper node; bearing leafy bracts at the nodes. *Spike* slightly flexuose, 2–6(–9)-flowered; *bracts* herbaceous with a hyaline margin, outer 12–20(–30) mm long, acute, inner slightly smaller, obscurely notched at apex. *Flower* white (–cream), facing downwards, usually opening in late afternoon and sweet-scented; *perianth tube* ca. 10 mm long, recurved, shorter than bracts, slightly wider towards apex; *tepals* subequal, outspread when open, 14–20 mm long, elliptic, 5–8 mm at widest, obtuse. *Filaments* ca. 5–6 mm long; *anthers* 6–8 mm, articulated and usually pendent. Ovary 3–4 mm long, style branches ca. 7–8 mm, pendent, reaching to near apex of anthers. *Capsule* ovoid, ca. 6 mm long. *Chromosome number* $2n = 26$ (Goldblatt 229 as *H. angusta*, 4937, 5754).

Flowering time: July—early October.

Distribution: clay slopes and flats, from the Richtersveld in the north, along the west coast, the interior south west Cape and western Karoo extending east through the Little Karoo to the eastern Cape at East London. Fig. 23.

Hesperantha bachmannii is a fairly common species in dry marginal habitats in the Cape Floristic Region, and the adjacent western Karoo, but its entire range is much wider. It reaches as far north as the arid Richtersveld in northern Namaqualand, and as far east as East London, where it occurs in more equable habitats such as river banks and forest margins. This considerable diversity of habitat is unusual and, surprisingly, is not reflected in any morphological pattern of variation. The species is very uniform over its range, although in very dry seasons poor growth often results in the development of dwarfed plants. The flowers are attractive when open, in late afternoon, when they have a strong sweet scent.

Hesperantha bachmannii is very closely related to *H. bulbifera*, a species that has been recorded in isolated places in eastern southern Africa, typically on steep rocky slopes or cliffs in damp situations. Morphologically the flowers of the two species are identical and *H. bulbifera* can only be distinguished by its larger corm, the presence of cormlets in the lower axils and a general tendency for larger leaves and flowers than *H. bachmannii*. Towards the eastern end of its range in the eastern Cape, some collections of *H. bachmannii* are markedly robust, and have relatively large corms, e.g. *Sidey 1157* from East London. These plants approach *H. bulbifera* in general appearance, but they lack the large axillary cormlets characteristic of this species.



FIG. 23.

Morphology of *Hesperantha bachmannii* and distribution of *H. bachmannii* and *H. bulbifera*. A: Habit and corm $\times 0,5$; flower life-size; gynoecium and partial flower $\times 2$ (voucher Goldblatt s.n., near Citrusdal).

Despite its small corm, *Hesperantha bachmannii* seems best placed in section *Imbricata*, for the overall corm structure is similar to other species of the section. *Hesperantha pallezens*, a local endemic of the Olifants River Mountains, has a comparable corm, and although its long-tubed flowers are very different, these two species are probably closely related within the section. *Hesperantha bachmannii* and *H. bulbifera* are unusual in section *Imbricata*, in having a recurved perianth tube. A curved perianth tube occurs elsewhere in the genus only in section *Radiata*.

Hesperantha bachmannii has long been known by the name *H. angusta*, under which name it was treated by Baker (1896) in *Flora Capensis*. It is still so named today in many herbaria, despite Foster's (1948) correct interpretation of the type of *H. angusta* as being quite different from the many collections given this name. *Hesperantha angusta* is a combination based on *Ixia angusta* Jacq. (Icones 2: tab 279, in text) and earlier named *I. linearis* by Jacquin in the *Collectanea* vol. 4 (1790) and under the figure 279 in the Icones. The original name was changed because it was a homonym for *I. linearis* L.f. (= *Gladiolus quadrangularis* (de la Roche) Barnard). *Ixia angusta* must be typified by the figure cited above, since no preserved material exists today. Careful examination of this illustration makes the conclusion seem likely that *I. angusta* is conspecific with *H. falcata*. As early as 1827 Ker (1827: 90) realised that *I. angusta* differed from *H. bachmannii*, for which he used the name *H. virginea* Banks nomen nudum, but he treated *H. angusta* as a synonym of *H. radiata*. This was later restated by Foster (1948) who used the name *H. bachmannii* for the species, the only available synonym. Reasons for regarding *H. angusta* as conspecific with *H. falcata* are discussed under the latter species.

SOUTH AFRICA, CAPE—2816 (Oranjemund): Hottentotparadysberg, top of Helskloof (-BD), Thompson & Le Roux 103 (K, MO, STE, PRE).

—2817 (Vioolsdrif): S of Van Zylsrus. S slopes (-CB), Thompson & Le Roux 312 (K, MO, STE, PRE); Kubus, main kloof (-AC), Marloth 12369 (B, PRE, STE).

—2917 (Springbok): Klipfontein (-BA), *H. Bolus s.n.* (Herb. Norm. Austr. Afr. 693) (BOL, G, GRA, P, SAM, UPS), Grant 4844 (LMA, MO); Steinkopf (-BD), Lewis 5514, 5498 (NBG), Herre s.n. (STE 18793); Steinkopfberge, Herre s.n. (STE 11825); Spektakel (-DA), Esterhuysen 5731 (BOL, PRE), Barker 1482 (NBG), Compton et al. 443/41 (NBG); Near Springbok (-DB), *L. Bolus s.n.* (BOL 31518), Acocks 16492 (PRE, K, UPS); Near Okiep, Morris s.n. (BOL 5787, K); Wildeperdehoek Pass, S facing slopes (-DC), Goldblatt 5754 (B, E, MO, PRE, S, US, WAG); Mesklip (-DD), Compton 5416 (NBG).

—2918 (Gamoep): 15 miles NE of Springbok (-CA), Compton 22029 (MO, NBG).

—3017 (Hondeklipbaai): Bowesdorp (-BB), Stokoe s.n. (SAM); Bowesdorp valley north of Kamieskroon, Goldblatt 5705 (MO); Karkams (-BD), Pearson 6533 (BOL), 6561 (K); 16 miles SW of Garies (-DB), Hall 3762 (M, NBG, PRE, STE).

—3018 (Kamiesberg): Leliefontein (-AC), Rodin 1471 (BOL, K, UC); Kamiesberg, Pearson 6666 (B, BOL, K, SAM); Kamiesberg, near Welkom, 3500 ft, Goldblatt

4318 (MO); 28,1 miles from Garies to Leliefontein, *Thompson* 437 (PRE, STE); Bitterfontein, Stinkfontein (-CC), *Pearson* 6562 (B); 10 km N of Bitterfontein, *Nordenstam* 1822 (S); Langebergen, summit (-DD), *Marloth* 12907 (PRE).

—3118 (Van Rhynsdorp): Farm Liebendal, 10 km N of Vredendal (-CB), *Hall* 4982 (NBG, PRE); Koudeberg (-DC), *Schlechter* 8726 (B, BOL, G, GRA, K, L, MO, PH, PRE, S, US, Z).

—3119 (Calvinia): Brandkop, Nieuwoudtville—Loeriesfontein (-AA), *Stokoe s.n.* (SAM 55620); Nieuwoudtville (-AC), *Grant & Theiler* 4872A (BOL), *Leipoldt* 815 (K); Klipkoppies, Nieuwoudtville, *Nordenstam* 2999 (M, S), *Barker* 9378 (NBG); Graskop road, near Buhr's house, *L. Bolus s.n.* (BOL 19591, K, PRE); Van Rhyns Pass, *Goldblatt* 130 (J); Oorlogskloof—Papkuilsfontein, *Leipoldt* 3034 (BOL); Melkbosfontein, 20 km E of Nieuwoudtville (-AD), *Thompson* 2896 (STE); 14 km from Calvinia on Loeriesfontein road (-BC), *Goldblatt* 3939 (B, C, MO, US); Lokenburg (-CA), *Acocks* 20605 (K, M, PRE); 26 miles NE of Calvinia, Moordenaarspoort (-BD), *Lewis* 2642 (SAM); Akkerdam, Calvinia, *Lewis* 5180 (NBG, S), *Acocks* 18628 (B, BOL, K, PRE), 18497 (PRE); W slopes of Hantamsberg, *Diels* 739 (B); Calvinia, northern hills, *Marloth* 10431 (PRE); Hantamsgebirge, *Meyer* 16 (B); 1 mile SW of Doorn R., on Calvinia road (-CC), *Lewis* 2283 (SAM); Doornbosch, *Barker* 1481 (NBG); Foot of Botterkloof (-CD), *Compton* 20923 (NBG); 17 miles N of Botterkloof (-DB), *Johnson* 564 (BOL, NBG).

—3218 (Clanwilliam): Lambert's Bay (-AB), *Marloth* 11660 (STE); Clanwilliam (-BB), *Loubser* 941 (NBG), *Salter* 2736 (K), 3681 (K); Olifants R., Clanwilliam, *Ecklon & Zeyher Irid.* 231 (B, G, LD, MO); Stony slopes E of Clanwilliam, *Diels* 291 (B); Bulshoek—Nardouwsfontein, along river, *Goldblatt* 3835 (E, M, MO, S, WAG); Foot of Mt. Synnot, along Bulshoek Dam, *Mauve & Oliver* 113 (STE); 10 miles N of Clanwilliam, *Leighton* 1383 (BOL, PRE); Near Velddrif (-CC), *Barker* 5809 (MO, NBG, UC); 6 miles N of Citrusdal (-DB), *Martin* 818 (NBG); Aggenbachsberg, SW of Clanwilliam, *Mauve & Oliver* 20 (STE).

—3219 (Wuppertal): Bidouw Mts. (-AA), *Compton* 20919 (NBG); Bottom of Bidouw Pass, *Mauve & Oliver* 88 (K, MO, PRE, S, STE), *Thompson* 399 (PRE); Bidouw, *Van Breda* 4277 (MO); Roadside at entrance to Wuppertal lands, *Goldblatt* 2532 (C, M, MO, NBG, PRE); Slopes above Welbedacht (-AC), *Lewis* 5224 (SAM, STE); Wuppertal, *Lewis* 5458 (NBG, S), *White* 5390 (PRE); S Cedarberg, near Bushman paintings (-AD), *Goldblatt* 229 (BOL); Matjiesrivier (-BC), *Wagener* 143 (NBG); 5 miles N of Citrusdal (-CA), *Compton* 17136 (BOL, NBG); 2 miles N of Citrusdal, *Lewis* 1354 (SAM); 10 km N of Citrusdal, *Thompson* 2794 (PRE).

—3220 (Sutherland): Verlaten Kloof (-BA), *Wall* 42 (S); Foothills of Verlaten Kloof, *Marloth* 9625 (PRE).

—3225 (Somerset East): Near Somerset East (-DA), *MacOwan* 3456 (SAM); Foot of the Boschberg, *MacOwan s.n.* (BOL 1485), 3456 (WU).

—3226 (Fort Beaufort): Bedford (-CA), *Mansell Weale s.n.* (GRA).

—3227 (Stutterheim): Boma Pass, 4 miles SW of Keiskammahoek (-CA), *Story* 3547 (K, PRE); King William's Town (-CD), *Sim* 19893 (PRE).

—3318 (Cape Town): Zwartland near Hopefield (-AB), *Bachmann* 1177 (B, G, Z).

—3319 (Worcester): Gydouw (-AB), *Leipoldt* 3033 (BOL); Titus R. valley, E of Eselsfontein (-AD), *Oliver* 5093 (K, MO, PRE, STE); Hottentotskloof (-BA), *Acocks* 1633 (S); Karooport, *Hafström & Acocks* 302 (S); Zwartkoppies, Spes Bona (-BB), *Marloth* 10470 (B, PRE); Bonteberg, Ceres distr. (-BD), *Compton* 3781 (BOL, NBG); Karoo Garden, Worcester (-CB), *Bayer* 251 (NBG), *Oliver* 283 (PRE); Hexrivierskloof (-DA), *Drège s.n.* (K, S); Rabiesberg slopes, *Lewis s.n.* (BOL 31519).

—3320 (Montagu): Whitehill, under bushes (-BA), *Compton s.n.* (SAM); Whitehill

Ridge, S side, *Compton 5621* (NBG); Near Matjiesfontein, *Marloth 9577* (PRE); Montagu Baths (-CC), *Page s.n.* (J); Kiesiesberg, Montagu distr. (-DB), *Lewis 1598* (PRE, SAM).

—3322 (Oudtshoorn): Swartberg Mts., near Kliphuisvlei on the road to The Hell, shale band, 1 450 m (-AC), *Vlok 715* (MO, NBG, SAAS).

—3324 (Steytlerville): Near Patensie, Beans Bush (-DB), *Bayliss 6034* (MO); Kliphfontein, near Andrieskraal (-DC), *Bayliss 6917* (K, MO); 5.5 km N of Hankey (-DD), *Goldblatt 4937* (MO, US, WAG); Zuurbroon-Gamtoos R., *Fourcade 3987* (BOL, K, STE); Klein River, Hankey, *Long 1347* (K, PRE); Hankey, beyond Bosch's farm, *Fourcade 5388* (BOL, STE).

—3325 (Port Elizabeth): Ripon (-BB), *Smith s.n.* (GRA, PRE 36345); Top of Zuurborg Pass (-BC), *Bayliss 5876* (K, MO); Enon, *Thode A2762* (K, PRE); Uitenhage distr. (-C), *Ecklon & Zeyher s.n.* (SAM 20816); Loerie R. (-CC), *J. L. Drège 205* (GRA); Van Staden's, *Paterson 73* (GRA); Uitenhage (-CD), *Loubser 902* (NBG); 2 miles S of Addo's Drift (-DB), *Fries, Norlindh & Weimarck 1214* (LD); Redhouse (-DC), *Fries, Norlindh & Weimarck 544* (K, LD, PRE, SAM), *498* (LD), *west 113* (GRA, K), *Long 1073* (K, PRE), *Rogers 3637* (PRE); Near Port Elizabeth, *Smith s.n.* (BOL 12982), *Hallack sub Galpin 3069* (PRE); Aloes, *Drège s.n.* (PRE 8041).

—3326 (Grahamstown): Near Middleton (-AB), *Rogers s.n.* (BOL 12982); Pluto's Vale (-BA), *Sampson s.n.* (GRA); Ecce Pass near Bothasberg, *MacOwan 345* (GRA, K); Grahamstown (-BC), *Rogers 1166* (BOL); Dassieklip, Albany (-CA), *Archibald 5290* (BOL); Alexandria, Sandflats (-CB), *Rogers 2226* (GRA).

—3327 (East London): River banks, East London distr. (-BB), *Sidey 1157* (MO); Forest edge, Buffalo Pass, *Batten s.n.* (NBG).

—3424 (Humansdorp): Duineveld E of Kromme R. mouth (-BB), *Fourcade 2777* (BOL).

Without precise locality: Little Namaqualand, *Scully 108* (STE, Z); *Ecklon & Zeyher 76.8* (L, Z); *Verreux 293* (G); Eastern frontier, *Hutton s.n.* (K); Rock ledges along banks of Gt. Fish River, *MacOwan 345* (BOL, G, K).

23. *Hesperantha bulbifera* Baker, *J. Bot.* 14: 183. 1876 et Flora Cap 6: 65. 1896; Foster, *Contr. Gray Herb.* 166: 8. 1948. Type: S. Africa, Cape, Boschberg, Somerset East, *MacOwan 2215* (K, lectotype here designated; BOL, G, K, PRE, WU, isoelectotypes).

Hesperantha sabiensis N.E. Br. ex Foster, *Contr. Gray Herb.* 166: 23. 1948. Type: S. Africa, Transvaal, Sabie, *Cunliffe s.n.* sub *Moss 4311* (K, lectotype here designated; PRE, Z, isoelectotypes).

Plants 200–300 mm long, usually trailing. *Corm* globose, 8–10 mm in diameter, base oblique, with a small downward projection; tunics dark brown, woody, entire above, notched below into segments, with tunics of previous years smaller, and accumulating in overlapping layers above. *Cataphylls* dry, membranous, 1–2. *Leaves* 3–5, linear to slightly falcate, flat, very thin-textured, about as long as the plant, 3–7 mm wide. *Stem* growing on steep slopes or cliffs, trailing, simple or with a branch produced from axil of a cauline leaf, bearing bulbils in all or many leaf axils. *Spike* slightly flexuose, 2–6-flowered; *bracts* herbaceous with a hyaline margin, outer 15–25(–30) mm long, acute, inner shorter, obscurely notched at apex. *Flow-*

er white (–cream), facing downwards, usually opening in late afternoon and sweet-scented; *perianth tube* 9–15 mm long, recurved, shorter than bracts, and emerging between them; *tepals* subequal, outspread when open, 16–20 mm long, elliptic, 5–8 mm at widest, obtuse. *Filaments* 6–7 mm long; *anthers* ca. 8 mm, articulated and usually pendent. Ovary 3–4 mm long, style branches ca. 14 mm, pendent, reaching to near apex of anthers. *Capsule* ovoid, 7–8 mm long. *Chromosome number* not known.

Flowering time: September–October in the Boschberg, May–July in Transvaal localities.

Distribution: moist, shady, montane habitats, on steep slopes or on cliffs, recorded from isolated localities, the Boschberg near Somerset East in the eastern Karoo, and in the Transvaal, on the Blaauwberg, on Kranzberg (Thabazimbi), and along the Drakensberg escarpment at Sabie and Mt. Sheba. Fig. 23.

Hesperantha bulbifera is closely allied to the widespread south western Cape–Namaqualand species *H. bachmannii*. Superficially the two species seem almost identical, except that *H. bulbifera* bears single, quite large cormlets along the stem in the axils of all or most of its leaves. In floral characteristics they share a strikingly similar series of features including a curved tepal tube emerging between the bracts, downward-facing flowers, pendulous anthers and similar long, narrow herbaceous bracts. Differences seem minor by comparison apart from the cormiferous condition in *H. bulbifera*, and include a generally more leafy habit, larger corms and flowers which, while similar to those of *H. bachmannii*, are consistently larger in all respects, falling in the upper range of the latter species.

They differ markedly in their habitats: *Hesperantha bulbifera* grows in damp shady situations on steep mountain slopes or on cliffs near running water. *Hesperantha bachmannii* by contrast grows in dry habitats in stony or sandy soils with its corms only shallowly buried in the ground.

Hesperantha bulbifera has an unusual, perhaps unique distribution range, and certainly so for Iridaceae. The type locality, and southernmost known station is the waterfall on the Boschberg near Somerset East in the eastern Karoo, a mountain complex in this semi-arid area. The four other records are far to the north in the Transvaal, also in montane situations, and populations here are reported as blooming from May to July, late autumn and winter, in contrast to spring on the Boschberg. It seems likely that further populations will be discovered when suitable habitats are investigated.

SOUTH AFRICA, TRANSVAAL—2328 (Addney): Top of Blaauwberg, above farm In der Mark, seepage areas in vertical cliffs (–BB), *Venter 6188* (PRE).

—2427 (Thabazimbi): Slopes of Kranzberg, foot of cliffs (-BC), *Venter* 1936 (PRE); Kranzberg, high slopes, *Germishuizen* 243 (K, MO, PRE).

—2430 (Pilgrim's Rest): Mt. Sheba Nature Reserve, crevices in rock ledges on cliffs (-DC), *Kerfoot* 8369 (J, MO, PRE).

—2530 (Lydenberg): Sabie (-BB), *Cunliffe* sub *Moss* 4311 (K, Z).

CAPE—3225 (Somerset East): Waterfall on Boschberg, in crevices in cliffs (-DA), *MacOwan* 2215 (BOL, G, K, PRE, WU).

Section HESPERANTHA

3. Section **Hesperantha**, *Ann. Missouri Bot. Gard.* **69**: 377. 1982.

Corm \pm symmetric, with a flat base, and campanulate to triangular in outline, tunics imbricate, outer covering inner above only, lower margins entire, or serrate or drawn into spines, sometimes notched below into \pm even-sized sections. *Flower* actinomorphic, usually whitish, yellow, or pink to purplish, occasionally with darker markings (in *H. luticola*); tube barely to well-exserted from bracts; anthers and style branches included in perianth tube in *H. cedarmontana*. Plants acaulescent in *H. luticola*, and usually so in *H. latifolia*.

Distribution: restricted to the winter rainfall area, from Port Elizabeth to the Cape Peninsula and north to the Richtersveld.

Species: 7.

Type species: *H. falcata* (L.f.) Ker

Section *Hesperantha* comprising seven species, is restricted to the winter rainfall areas of the south western Cape, Namaqualand and the western Karoo. All species have flat-sided corms, campanulate to triangular in outline, often with toothed or spiny margins. Two species, *H. latifolia* and *H. luticola*, are acaulescent and grow in seasonally moist sites such as rock pools and stream edges. Both have long perianth tubes. Other species have fairly small, relatively short-tubed flowers, but *H. cedarmontana* is unusual in having included stamens and a very short style and style branches enclosed in the perianth tube. *Hesperantha spicata* and the very localised *H. saldanhae* usually have a large number of very small flowers per spike. *Hesperantha spicata* subsp. *spicata* often has leaves with undulate margins, while subsp. *fistulosa* has hollow, terete leaves. *Hesperantha falcata* is the only widespread species, and is very variable. Its flowers may be white or occasionally yellow or cream. While pale-coloured flowers are the rule in section *Hesperantha*, *H. pauciflora* and *H. latifolia* have pink to deep purple flowers.

24. ***Hesperantha falcata*** (L.f.) Ker, *Konig & Sims Ann. Bot.* **1**: 225. 1805; Baker, *Handbk. Irid.* **148**. 1892 et *Flora Cap.* **6**: 58. 1896. Fig. 24.

Ixia falcata L.f., *Suppl. Pl.* **92**. 1782. Type: South Africa, Cape, hills around Cape Town, *Thunberg s.n.* (Herb. Thunb. 952 β , UPS, lectotype

here designated); syntypes 953 α , 955 γ and 956 δ [= *Geissorhiza imbricata* (de la Roche) Ker].

Hesperantha angusta (Jacq.) Ker, König & Sims Ann. Bot. 1: 225. 1805; non sensu Baker, Handbk. Irid. 152. 1892 et Flora Cap. 6: 65. 1896.

Ixia angusta Jacq., Ic. Pl. Rar. 2: 7 (in conspectus tabularum, non sub tabulum) 1793, nom. nov. pro *Ixia linearis* Jacq. hom. illeg.

Ixia linearis Jacq., Coll. Bot. 4: 1790, et Ic. Pl. Rar. 2: tab. 279. 1793/4. hom. illeg. non *I. linearis* L.f., 1782 [= *Gladiolus quadrangulus* (de la Roche) Barnard]. Type: South Africa, Cape, without precise locality, figure in Jacq., Ic. Pl. Rar. 2: tab. 279 (lectotype).

Hesperantha linearis Fourc., Trans. Roy. Soc. S. Africa 21: 77. 1934, intended as a new combination, but treated here as nom. nov. pro *I. linearis* Jacq. hom. illeg.

Hesperantha lutea Eckl. ex Baker, Handbk. Irid. 149. 1892 et Flora Cap. 6: 60. 1896; Foster, Contr. Gray Herb. 166: 20. 1948. Type: S. Africa, Cape, Caledon distr., Zeyher s.n. (K, holotype) [specimens of Ecklon & Zeyher Irid. 216 (B, G, L, LD, MO) and Ecklon & Zeyher s.n. (51.9) (B, C, E, GH, LD, PRE, UPS, UW, Z) from Caledon Zwartberg near the Baths, are probably isotypes].

Hesperantha lutea var. *luculenta* Foster, Contr. Gray Herb. 166: 19–20. 1948. Type: South Africa, Cape, hills at Berg River bridge, Piketberg, Schlechter 5261 [GH, holotype (not seen); B, BOL, G, K, P, PRE, S, Z, isotypes].

Geissorhiza pauciflora Baker, Bull. Herb. Boiss. ser. 2, 4: 1004. 1904; Foster, Contr. Gray Herb. 166: 21. 1948, in synonym. sub *H. pentheri*. Type: South Africa, Cape, near Porterville, Schlechter 4891 (K, lectotype here designated; B, BOL, G, W, Z, isolectotypes).

Hesperantha insipida Lewis, Jl S. Afr. Bot. 7: 56. 1941 as nom. nov. pro *Geissorhiza pauciflora* (*H. pauciflora* Lewis bars combination in *Hesperantha*).

Hesperantha pentheri Baker, Kew Bull. 1906: 26; Foster, Contr. Gray Herb. 166: 21–22. 1948. Types: South Africa, Cape, Olifants R., Clanwilliam Div., Penher 686 (K, lectotype effectively designated by Foster, 1948); Penher 625 (? K, not seen, syntype).

Hesperantha trifolia Foster, Contr. Gray Herb. 166: 26. 1948. Type: South Africa, Cape, Bull Hoek, Schlechter 8378 (B, holotype; BOL, G, K, MO, PH, P, PRE, US, Z, isotypes).

Hesperantha maritima Eckl., (Ecklon & Zeyher Irid. 298) ms. et Top. Verz. 23. 1827. nom nud.

Hesperantha pallida Eckl., (Ecklon & Zeyher Irid. 236) ms. et Top. Verz. 23. 1827. nom nud.

Hesperantha collina Schltr. ms. (Schlechter 10742).

Plants 60–200(–300) mm high. *Corm* \pm symmetric, (5–)8–15 mm in diameter at base, campanulate to triangular in outline, with flat base, tunics imbricate, dark brown to black, older layers accumulating above, breaking into segments below, lower margin often with radiating spines or teeth. *Cataphyll* dry, solitary, membranous, sometimes evidently lacking. *Leaves* 3–4(5), all basal or upper inserted near stem base, (20–)50–80(–150) mm long, falcate or erect and ensiform, sometimes obtuse at apex (2–)4–8 mm wide, uppermost or upper two leaves sheathing lower part of stem (occasionally fifth leaf may be bract-like), margin sometimes slightly thickened and hyaline. *Stem* erect, single or 2–3-branched from near base, occasionally also from axil of uppermost leaf. *Spike* (1–)3–8-flowered; *bracts* herbaceous, often reddish and becoming dry at apices, 6–13(–15) mm long; inner narrower, sometimes slightly shorter. *Flower* hypocrateriform, white, pale to deep yellow or rarely cream, outer tepals flushed red, pink or brown on reverse, white forms opening towards 17h00 and then scented, closing towards dawn, yellow forms scentless and day-blooming; *perianth tube* cylindric, 4–9 mm long; *tepals* subequal, (9–)12–18 mm long, narrowly ovate to elliptic, 5–7 mm at widest point. *Filaments* 3–4 mm long; *anthers* (3–)4–7.5 mm long. *Ovary* 2–3 mm long, style branches 6 mm long. *Capsule* obovoid, 7–10 mm long, somewhat shorter to slightly exceeding bracts. *Chromosome number* $2n = 26$ (Goldblatt s.n. no voucher – Malmesbury commonage; Goldblatt 4763, 4756, 5644, 149, 4847).

Flowering time: August–September (late July in the north–early October in the south).

Distribution: throughout the Cape Floristic Region, from Lokenburg in the north to Port Elizabeth in the east; on various soils from heavy clay to coarse sand. Fig. 24.

Hesperantha falcata is one of the more widespread of the species of *Hesperantha* of the winter rainfall region. It is restricted to the Cape Floristic Region, and occurs almost throughout this area, with the exception of the northern half of the Nieuwoudtville escarpment and drier areas of the west and south coasts. It is similar to several other species in its moderate-sized and usually white flower with dark reddish pigmentation on the reverse of the outer tepals, but it is distinctive in its leaves and corms. The fairly broad leaves are usually falcate and when dry have a fine parallel venation pattern. The corm is campanulate to triangular in outline and the lower margins of the imbricate tunics are lightly to strongly serrate or spinose. In the absence



FIG. 24.

Morphology and distribution of *Hesperantha falcata*. Habit $\times 0.5$; flower and corms life-size (vouchers: Goldblatt s.n. no voucher, Kirstenbosch Gardens; corm lower left Goldblatt 5644 below Piekens Kloof Pass; corm lower right Goldblatt 5199, Keurbooms River).

of corms *H. falcata* is easily confused with *H. cucullata* and broader-leaved specimens of *H. acuta*, both of which have almost identical flowers.

Hesperantha falcata is normally an outcrossing species, but several accessions have been observed to be facultatively autogamous in the greenhouse, where many flowers on a spike will set fruit by their own pollen. These capsules usually contain a reduced number of fertile seeds. A small-flowered form from the southern Cape appears to be completely autogamous, setting full capsules in the greenhouse with its own pollen.

The species was one of the first members of the genus to be described. It was collected by Thunberg in the 1770's and was described, as *Ixia falcata*, by the younger Linnaeus in 1782. I have selected *Hesperantha falcata* as type species of the genus.

Hesperantha angusta (basionym *Ixia angusta* Jacq., 1793) is probably an early synonym, although the name *H. angusta* has sometimes been applied to *H. bachmannii* (e.g. Baker, 1896) (see discussion under that species). The type figure of *I. angusta* has a flat based campanulate corm like that of *H. falcata*, narrow and possibly somewhat fleshy falcate leaves and white flowers with a more or less straight perianth tube. The figure is too poor for definitive identification, but it seems closest to *H. falcata*.

Hesperantha falcata is one of the most variable species in the genus and as treated here, comprises a range of forms placed by Baker (1896; 1904) and by Foster (1948) in as many as six separate taxa. These are in addition to *H. falcata* sensu stricto: *H. lutea* Ecklon ex Baker; *Geissorhiza pauciflora* Baker, which is *H. insipida* Lewis (a required nomen novum since *H. pauciflora* is preoccupied); *H. pentheri* Baker (in which Foster included *H. insipida*); *H. trifolia* Foster; and *H. lutea* var. *luculenta* Foster. All these names (excepting *H. insipida*, which seems indistinguishable from *H. pentheri*) do represent distinct forms of *H. falcata* but they differ in relatively insignificant ways from one another. They also do not comprise the entire range of variation in the complex in which other notable variants are: a marsh form with very long, erect leaves; a southern Cape form with small and often very few flowers; and populations from the Witteberg area which comprise short plants having leathery leaves with distinctly thickened margins.

The form called *Hesperantha lutea* has deep yellow flowers, but differs in no other morphological feature from typical *H. falcata*. It occurs in the southern Cape from Caledon in the west to George in the east, usually on clay soils and in drier sites in renosterbos vegetation. Its flowers bloom during the day, opening at midday and closing in the late afternoon in contrast with typical *H. falcata*, which is evening-blooming, and occurs on generally moister sites either on clay or more often on sandy soil.

Hesperantha lutea var. *luculenta* is another colour form of *H. falcata*, but probably not related directly to *H. lutea*. It has pale yellow flowers and also occurs on clay soils, but is restricted to shale flats in the Swartland on the plains between Piketberg and Porterville. The flowers are a much paler yellow than those of *H. lutea*.

Hesperantha pentheri and *H. insipida* represent a form with even paler yellow flowers, perhaps better described as cream or ivory. Plants matching their types occur to the north in the Olifants River valley and have notably narrower tepals than *H. lutea* var. *luculenta*. This form also has narrower floral bracts than are usual in *H. falcata*, but the white-flowered form of

H. falcata, also found in the Olifants River valley, has similar narrow bracts, and this form corresponds with the type of *H. trifolia*. The majority of collections of *H. falcata* from the Olifants River valley and adjacent areas have three leaves, both white and cream-flowered forms, in contrast to forms *H. falcata* occurring to the south in the rest of its range. Occasionally, however, populations of robust individuals comprise plants with four or even five leaves, although their flowers correspond exactly with populations having consistently three leaves (Ecklon & Zeyher *Irid.* 234; Goldblatt 3868, 5657).

The smallest and most dwarf specimens of *Hesperantha falcata* occur in the most northern part of its range, in the lower Olifants River valley, and in some of the drier valleys and mountains nearby. Here the climate of the Cape Region is most extreme, with low and unpredictable rainfall, and the variability is undoubtedly a result of climatic variation from year to year and place to place. The dwarf form is very like *H. trifolia* in its flower and seems to represent merely a depauperate growth form of this genotype.

Besides the several forms described above, there are three more that need be mentioned. One is a narrow and erect-leaved plant which grows in wet, even marshy, sites in the south western and southern Cape (e.g. Lewis & Davis 2230; Baker 2492). The second is a small-flowered form from the eastern end of the range of the species (Fourcade 3362; Goldblatt 4922) in which the flowers have a tube 5 mm long, and tepals 9–11 mm long. The third comprises plants that are often small (ca. 100 mm tall) and always with short and rather leathery leaves (30–40 mm long) the margins and midrib of which tend to be thickened (Compton 12242; Barker 3034; Compton 16269; Leighton 221). These occur on the Witteberg and adjacent mountain areas.

This variation pattern is more complex than that found in most species of the genus and it is difficult and perhaps even unnecessary to devise an acceptable taxonomy to reflect the situation. Each form is connected to some extent with others through intermediates and it is sometimes difficult to distinguish one from another, so that specific recognition of any seems unwarranted. Intraspecific recognition of any form would, for the sake of consistency, seem to require recognition of several others. The admission of subspecies based solely on colour differences is unsatisfactory and thus *H. lutea*, *H. lutea* var. *luculenta* and *H. pentheri* are reduced to synonymy.

The southern Cape small-flowered form, and the long-leaved marsh form seem to be no more than ecotypes and do not merit taxonomic recognition as such. This leaves only the west coast and Olifants River populations. These seem intuitively more distinct than other variants in their frequent possession of three leaves, narrow and attenuate floral bracts and often quite large flowers, but careful examination of all the material at my disposal suggests that it would be of little value to accord even these popu-

lations any formal taxonomic status. The characters that distinguish them occur in populations in other parts of the range of *H. falcata* although less commonly than in the Olifants River valley.

This treatment accords no formal recognition to the various colour forms but those requiring a name for the three distinct flower colour races should follow Burtt's (1970) suggestion of the use of an infraspecific epithet without denoting rank—essentially a trinomial—thus *Hesperantha falcata (lutea)* or *H. falcata (luculenta)* etc. My treatment may seem arbitrary, but my decision has been influenced by my field experience as much as by herbarium material. In the field *H. falcata* and *H. trifolia* seem much less distinct than in the herbarium, while the flower colour races seem rather more distinct when seen alive, when colour seems overly significant. This treatment of *H. falcata* accords with that for *H. pilosa* and *H. acuta* in which colour forms are also given no taxonomic recognition.

In the listing of exsiccatae that follows, all yellow-flowered forms have been highlighted with an asterisk.

SOUTH AFRICA, CAPE—3118 (Vanhynsdorp): Top of Nardouw Pass (-DC), *Goldblatt 6163* (MO); Olifants R. Barrage (-DD), *Compton 11050* (NBG), *Esterhuysen 5377* (BOL); Bulhoek, *Wall 42* (LD); Bullhoek, *Schlechter 8378* (B, BOL, G, K, MO, PH, US, Z).

—3119 (Calvinia): Lokenburg (-CA), *Puff 80/0901* (MO), *Leistner 308* (PRE).

—3218 (Clanwilliam): Rietvleiberg (-BA), *Oliver 3831* (K, PRE, STE); Clanwilliam (-BB), *Compton 10993* (NBG), *Schlechter 8589* (B, PRE); am Fluss Olifanttrivier und bei Villa Brakfontein, *Ecklon & Zeyher Irid. 234* (76. 9) (MO, SAM), **Ecklon & Zeyher Irid. 212* (76) (B, G, MO, SAM); Between Nardouws Kloof and Bulshoek, *Goldblatt 3839* (MO); Clanwilliam—Graafwater, near Olifants R. bridge, **Salter 3538* (BOL, K); Boschklouf, *Schlechter 8459* (B, BOL, G, K, PH, PRE, W, Z); Verlorenvlei (?-BC), *Barker 2613* (BOL, NBG); Between Alpha and Rondegat (-BD), *Goldblatt 6150* (MO, US, WAG); Near Rondegat, **Goldblatt 2187* (M, MO, NBG); 10 miles S of Clanwilliam, *Lewis & Davis 2496* (SAM); The Rest, below Piekieniers Kloof (-DB), *Gillet 3707* (BOL, STE), *Goldblatt 5644* (MO); Slopes above Berg River at bridge near Piketberg (-DC), **Schlechter 5261* (B, BOL, C, G, K, PRE, S, UPS, Z), **L. Bolus & Lewis s.n.* (Nat. Bot. Gard. 1825/32 in BOL, K).

—3219 (Wuppertal): Citadelkop (-AA), *Compton 24241* (NBG); Bidouw Valley, *Goldblatt 6161* (MO); Near top of Pakhuis Pass, *Goldblatt 6399* (MO, UC); Pakhuis Pass west of Leipoldt's Grave, *Goldblatt 6402* (MO); Lammkraal, *Schlechter 10850* (B, BOL, G, K, MO, PH, PRE, US, Z); Bidouw, Pass into valley, *Thompson 338* (PRE); Between Clanwilliam and Algeria, S slopes (-AC), *Goldblatt 3868* (M, MO, S, WAG); Shale hillside E of Citrusdal (-CA), **Goldblatt 6144* (MO, PRE, WAG); Elandskloof, *Esterhuysen 3160* (BOL, PRE), *Compton 9671* (NBG), *16238* (NBG), *Oliver 4019* (K, PRE, STE), *Lewis s.n.* (BOL); Citrusdal, *Martin 814* (NBG, STE) *Lindeberg s.n.* (S); Cold Bokkeveld, Waboomsrivier-Yzerfontein (-CC), *Lewis 2643* (SAM).

—3318 (Cape Town): Near Hopefield (-AB), *Bachmann 222* (B); Leliefontein, near Hopefield, *Bachmann 1173* (B, Z); Darling (-AD), *Rogers 14001* (PRE), *Bachmann 514* (B, Z); Clay hills, Darling, *H. Bolus s.n.* (BOL 12839); Klipkop, Darling, *Bachmann 1174* (B, Z); Mamre hills, *Barker 1812* (NBG); Porterville (-BB), **Loubser*

462 (NBG), **Schlechter* 4891 (B, BOL, G, K, W, Z), 2570 (PRE); Malmesbury common (-BC), *Salter* 8438 (SAM); Riebeek Kasteel (-BD), *Esterhuysen* 6030 (BOL, PRE); Camps Bay (-CD), *Marloth* 150 (PRE), *Zeyher* 141 (SAM), *Prior s.n.* (K, Z); Lions Head, *Drège s.n.* (S), *Zeyher s.n.* (SAM 20787), *Wilms* 3704 (B); Foot of Lions Head, *Guthrie s.n.* (BOL); Lower W slope of Lion's Head, *Lewis* 1076 (SAM); Signal Hill, *Wilms* 3751 (B, G, PH, WU); Stinkwater, *Rehmann* 1198 (Z); Kenilworth, *L. Bolus s.n.* (BOL 13945); Cape Town, *Prior s.n.* (Z); Paarden Eiland, *Ecklon s.n.* (S); Table Mt., *Thode* 9222 (STE), *Ecklon s.n.* (S), *Pappe s.n.* (S); Table Mt., lower plateau, *Lewis* 972 (SAM); Foot of Window Gorge, *Stokoe* 8838 (BOL); Tamboers Kloof, Cape Town, *Zeyher* 5032 (SAM); N slope of Devil's Peak, *Diels* 87 (B); "Bergplatze bei der Kapstadt", *Ecklon & Zeyher Irid.* 298 (B, LD, MO); Klipheuwel (-DA), *Thompson* 2593 (PRE); Dal Josaphat (-DB), *Grant* 2337 (BOL, MO); Wellington, *Grant* 2243 (MO), *Compton* 11631 (M, NBG); Near Wellington, *Grant* 2366 (MO, PRE); Paarl, *Story* 3031 (PRE); Langverwacht, Kuils River (-DC), *Oliver* 4331 (K, MO, PRE, S, STE); North of Tygerberg, *Barker* 4812 (BOL, NBG), *Compton* 20064 (NBG); Hasendal, Kuils River, *Rycroft* 2327 (NBG); Hercules Pillar (-DD), *Compton* 1163 (NBG); Blaauwklip, Stellenbosch, *Gillett* 589 (BOL, STE); Stellenbosch flats, *Garside* 1502 (B, K); 3 km N of Koelenhof, *Thompson* 2620 (PRE, STE); Bottellary road, near Stellenbosch, damp ground, *Lewis & Davis* 2230 (NBG, PRE).

—3319 (Worcester): Near waterfall, Porterville (-AA), *Edwards* 36 (J); Porterville, hills, 300 m, *Schlechter* 4882 (K); Saron Kloof, *Martin* 1896/36 (NBG); De Hoek Estates, Saron, *Lewis s.n.* (BOL 31528); Near Tulbagh Road turnoff, in renosterveld along national road (-AC), *Goldblatt* 4756 (MO); Sandy flats at top of Tulbagh Falls, *Goldblatt* 4763 (MO, WAG); Steendal, Tulbagh distr., *Drège s.n.* (SAM), *Pappe s.n.* (BOL 31534); Bains Kloof (-CA), *Wall* 42 (S), *Esterhuysen* 35560 (MO); Michells Pass (-AD), *Esterhuysen* 6146 (BOL); Hottentots Kloof (-BA), *Barker* 1479 (NBG); Matroosberg, near Lakenvlei (-BC), *Phillips* 2075 (SAM); Verkeerdelei (-BD), *Horrocks* 105 (NBG); Botha's Halt, Worcester (-CA), *Gillett* 252 (BOL, STE); Brandvlei, sandy flats (-CB), *Lewis* 6050 (NBG, STE); Brandvlei, 18 miles N of Villiersdorp, *Marsh* 888 (PRE, STE); Hex River valley (-CC-DA), *Tyson* 716 (SAM), *Davidson s.n.* (SAM 16); 4 miles N of Villiersdorp towards Worcester (-CC), *Marsh* 854A (STE); Eendracht (-DB), *Lewis* 1597 (SAM); 10 miles from MacGregor towards Bonnievale (-DD), *Marsh* 805 (PRE, STE).

—3320 (Montagu): Tweedside (-AB), *Lewis s.n.* (Nat. Bot. Gard 2690/32 in BOL, K); Witteberg at Whitehill (-BC), *Compton* 16269 (NBG); Witteberg at Bantams, *Compton* 12242 (NBG); Witteberg, *Leighton* 221 (BOL); Palmyra, Heidelberg distr. (-CC), **Loubser* 2128 (NBG).

—3321 (Ladismith): Corente R. farm, Riversdale distr. (-CC), *Muir* 5361 (BOL, PRE).

—3323 (Willowmore): Onder Kouga, E. Cape (-CB), *Bayliss* 7154 (MO); Ruytersbos (-CC), *Van Niekerk* 87 (BOL, K); Nature's Valley, forest margin (-DC), *Acocks* 21499 (K, PRE).

—3324 (Steytlerville): Campanies Drift (-CC), *Fourcade* 2314 (K).

—3325 (Port Elizabeth): Thornhill (-CC), *Cruden* 438 (PRE); Near Bethelsdorp (-DC), *Pappe s.n.* (SAM 25200); Port Elizabeth, *Rosenbrock* 173 (B); Near Port Elizabeth, *West* 64 (K); Aerodrome, Port Elizabeth, *Long* 200 (K).

—3418 (Simonstown): "Clivis montis pr. Simonstown" (-AB), *Schlechter* 1196 (B, BOL, G, WU, Z); Hout Bay, *Acocks* 4751 (S), *Bond* 438 (NBG), *Compton* 11756 (BOL, NBG); Tokai, *Rogers* 16173 (Z); Fish Hoek, *Wolley Dod* 1416 (BOL); Olifantsbos, Cape Peninsula (-AD), *White* 5527 (PRE); Isoetes Vlei (-BA), *Rowe* 29 (NBG); Hottentots Holland (-BB), *Zeyher s.n.* (SAM 25199); Sir Lowry's Pass,

Schlechter 1143 (B, BOL, M, WU); Waterkloof, Somerset West, *Parker 3814* (BOL, GH, K, NBG); Between Dwarsberg and Somerset Sneeuwkop, Hottentots Holland, *Stokoe s.n.* (SAM 58711); Hangklip (-BD), *Gillett s.n.* (MO); Rooi Els, *Barker 2792* (NBG).

—3419 (Caledon): Clay slopes east of Queen Anne (-AA), *Goldblatt 2496* (B, MO, PRE, US, WAG); Between Eseljag and Queen Anne, *Goldblatt 4000* (MO); Flats E of Viljoen's Pass, *Stokoe s.n.* (SAM 61732); Caledon road, 1 mile from Villiersdorp turnoff (-AB), *Barker 7* (BOL, K, PRE); Caledon Baths, *Guthrie 2529* (NBG); Hill N of Baths, Caledon, *Marloth 92227* (PRE, STE); Caledon Zwartberg and Baths, *Ecklon & Zeyher s.n.* (51.8) (PRE), *Ecklon & Zeyher Irid. 236* (51.8) (B, LD, MO, S, SAM); Slopes of Caledon Zwartberg near Baths (-AB), **Templeman sub Mac-Owan 2609* (BOL, S, SAM), **Ecklon & Zeyher s.n.* (51.9) (B, C, E, GH, L, LD, PRE, UPS, WU, Z), **Ecklon & Zeyher Irid. 216* (52.8) (B, G, LD, MO); Near gates to Caledon Baths, **Barker 12* (K); Zwartberg, **Atherstone 276* (B); Burned clay slope, W end of Caledon, *Goldblatt 5790* (MO); Kleinmond, near coast (-AC), *De Vos 1* (B); Fern Kloof, Hermanus (-AD), *Goldblatt 5971* (MO); Vogelklip, Hermanus, *Barker 1789* (NBG); Vogeltgat, *Williams 2585* (PRE); Entrance to Vogelgat Reserve, *Goldblatt 4854* (MO); Mossel River, Hermanus, *Compton 23624* (NBG); Foot of Steenboksberg, on Stanford-Caledon road, **Goldblatt 4097* (MO, PRE, US, WAG); Kleinriviersberg, (-AD-BC), **Ecklon & Zeyher Irid. 215* (K, SAM (58.8)); Riviersondereinde (-BB), *Zeyher 3962* (PRE, SAM); Fairfield farm (-BD), *Thompson 3218* (K, PRE); NE of Sandy's Glen, near Fairfield, **Goldblatt 4847* (M, MO, S, WAG); Frikies Bay, sand flats (-CB), *Compton 18199* (NBG); West of Elim (-DA), *Muir 5021* (NBG); Elim (-DB), *Frowein 16308* (PRE).

—3420 (Bredasdorp): Grassy places between Stormsvlei and Riviersonderend (-AA), *Gillett 1139* (STE); Bontebok Park, vlei on road to "old garden" (-AB), *Liebenberg 7399a* (PRE, STE); Bontebok Park, SE of Swellendam, **Liebenberg 6542* (PRE); Dronkvlei, entrance gate (-AD), **Burghers 2433* (STE); Ruggens near Zuurbraak, 800 ft (-BA, -BB), **Galpin 4683* (BOL, K, PRE); Between Heidelberg and Zuurbraak, **Lewis 5653* (NBG, STE); Zuurbraak, S slopes (-BA), **Rycroft 3124* (NBG), **Acocks 24140* (K); Grootvadersbos, **Ludwig & Beil s.n.* (S); Jantjies Bos, farm Nachtwacht, Bredasdorp (-CA), *Smith 2991* (PRE); The Poort, Bredasdorp, *Barker 2528* (NBG), *Barker 2492* (NBG).

—3421 (Riversdale): Riversdale (-AB), **Rust 28* (B), **Rogers 4396* (BOL, Z); Stilbaai-Blombos road, Riversdale distr. (-AD), *Wurts 1527* (NBG); Weltevreden, near Albertinia (-BA), **Muir 997* (BOL, PRE, SAM).

—3422 (Mossel Bay): Pacaltsdorp, fynbos on cliffs above the sea (-AB), **Moriarty 585* (NBG); Sedgfield (-BB), *Cassidy 223* (NBG); Belvedere, Knysna, *Duthie 1141* (BOL, STE).

—3423 (Knysna): Knysna, lawn weed (-AA), *Cassidy 226* (NBG); Keurbooms River, sand at edge of bush near hotel (-AB), *Goldblatt 5199* (MO); 1.6 miles W of Keurbooms R. on Plettenberg Bay road, *Mauve 4611* (K, PRE).

—3424 (Humansdorp): Witte Els Bosch (-AA), *Fourcade 911* (BOL); Oudebosch flats, *Fourcade 3362* (K, MO, PRE, STE); Humansdorp (-BB), *Thode A1037* (PRE); Hillside, Humansdorp, *Galpin 4670* (K, PRE); 4.6 km S of Humansdorp, *Goldblatt 4922* (MO); Seekoei River, *Montgomery 36* (STE).

Without precise locality: C.B.S., *Bergius 478* (B); *Bowie s.n.* (G); *Roxburgh s.n.* (G); *Lichtenstein 478* (B); *Thom s.n.* (K); **Lehmann s.n.* (S); *Drège 4892* (S); *Sparrman s.n.* (S); *Thunberg s.n.* (S, UPS); *Pappe s.n.* (S, Z); Porterville, hills, *Schlechter 10742* (B, BOL, G, K, MO, PRE, Z), 4882 (B, BOL, SAM, WU, Z); Remhoogte, Ceres distr., *Marloth 10605* (MO, PRE, STE); Olifants R. valley, *Penther 686* (K), *Barker 5605* (NBG); Riversdale distr., **Muir 4883* (K).

25. *Hesperantha cedarmontana* Goldbl., sp. nov. Fig. 25.

Plantae 120–450 mm altae, *cormo* ca. 12 mm in diametro, campanulato, tunicis imbricatis, *foliis* 3, inferioribus duobus basalibus, *spicis* (1–)3–8 floribus, *bracteis* (6–)10–14 mm longis, *floribus* hypocrateriformibus, albis-cremeis, *tubo perianthii* 10–13 mm longo, staminibus inclusis, *tepals* 10–12 mm longis, *filamentis* ca. 1 mm longis, *antheris* 5–6 mm longis, in tubo inclusis, apicibus vix emergentibus, ramis styli in tubo inclusis.

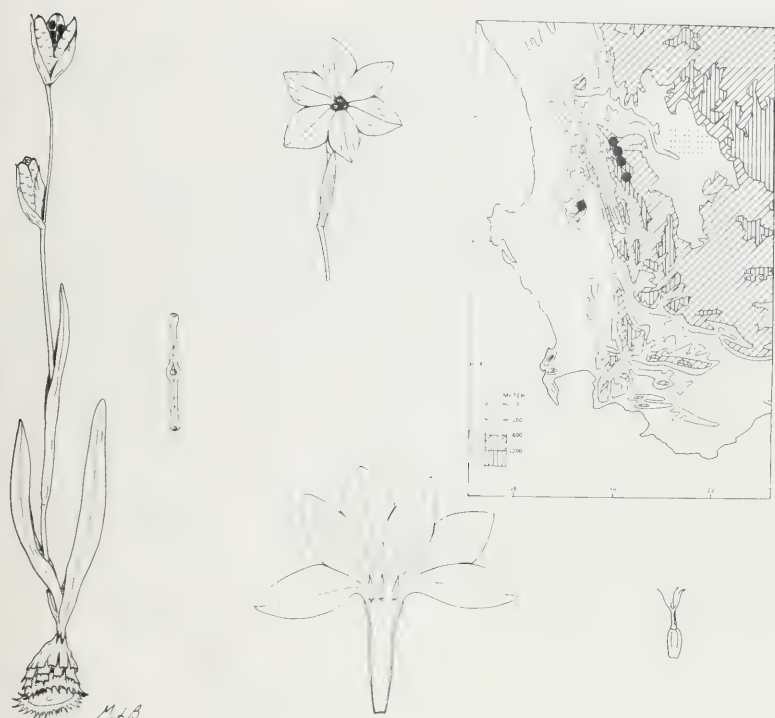
Type: S. Africa, Pakhuis Mts., near Leipoldt's grave, Goldblatt 6403 (MO, holotype; K, NBG, PRE, isotypes).

Plants (120–)150–250(–450) mm high. *Corm* campanulate, symmetrical, flat based, ca. 12 mm in diameter at widest, tunics brown, imbricate, outer layers progressively smaller, margins notched below into segments, each with an irregularly fringed to serrate lower margin. *Cataphyll* solitary, membranous to brownish, and often broken. *Leaves* 3, usually less than half the length of the stem, lower 2 basal and often prostrate, margins sometimes thickened, apices often obtuse, upper leaf basal, or inserted above ground, and sheathing stem at base, or in lower half, and with short free apex. *Stem* erect, unbranched, bearing a short sheathing bract in upper half. *Spike* (1–)3–8-flowered, flexuose, lax; *bracts* (6–)10–14 mm long, herbaceous, margins hyaline and often red-flushed at apices, inner about as long as outer. *Flower* hypocrateriform, white-cream, flushed pinkish on reverse of outer tepals, opening towards evening and then richly carnation-scented; *perianth tube* 10–13 mm long, straight, exserted from bracts; *tepals* 10–12 mm long, outspread when fully open, ca. 4 mm wide, lanceolate-elliptic. *Filaments* less than 1 mm long, included in tube; *anthers* ca. 3.5 mm long, contiguous, apices just emerging from perianth tube. *Ovary* ca. 2 mm long, style very short, ca. 3 mm long, dividing in lower half of perianth tube, branches included in tube and reaching to middle only or to the apex and contiguous with the anthers. *Capsule* 10–15 mm long, ovoid-oblong, apex exserted from bracts. *Chromosome number* $2n = 26$ (Goldblatt 5130, 6403.)

Flowering time: September–late October, at higher altitudes; flowers opening 18h30–19h00, closing before daylight.

Distribution: Cedarberg and Cold Bokkeveld Mountains, in shallow, seasonally moist soils usually among rocks, middle to high altitudes, and on Zebrakop in the Piketberg. Fig. 25.

The corm and general habit of *Hesperantha cedarmontana* are very like *H. falcata*, and the two are easily confused unless the floral details are examined. *Hesperantha cedarmontana* has very short filaments, less than 1 mm long, inserted in the middle of the perianth tube, while only apices of the



Hex Berg in the Cold Bokkeveld in the south. An outlying population was discovered in 1980 by Elsie Esterhuysen on Zebrakop, *Esterhuysen 34596*, in the Piketberg Mounfains. The species grows in damp, often shady places, frequently on the south side of rocks and boulders, or in crevices in cliffs.

SOUTH AFRICA, CAPE—3218 (Clanwilliam): Pakhuis Pass (-AA), *Esterhuysen 3192* (BOL), *Lewis 1863* (SAM), *Barker 4708* (NBG); Pakhuis Pass, 2500 feet, *Bond 603* (NBG); Near Leipoldt's Grave, Pakhuis Mts., *Goldblatt 6403* (K, MO, NBG, PRE); Zebrakop, Piketberg (-DB), *Esterhuysen 34596* (BOL, MO) —3219 (Wuppertal): Welbedacht valley, Cedarberg, 5500 feet (-AC), *Barnes s.n.* (BOL 19472); Middelberg, Cedarberg 4500 feet, *Kerfoot 5964* (NBG), *Goldblatt 5130* (MO); Welbedacht Kloof, *Stokoe s.n.* (SAM 55683); Krakadouw Peak, damp ledge, *Esterhuysen 12089* (BOL); Hexberg, Cold Bokkeveld (-CA), *Goldblatt 7120* (MO).

26. *Hesperantha pauciflora* Lewis, Fl. Pl. Africa 18: tab. 682. 1938. Fig. 26.

Tritonia pauciflora Baker, Handbk. Irid. 193. 1892, et Flora Cap. 6: 124. 1896. Namaqualand, Mts. near Naries, 3 400 feet, *Bolus 6622* (BOL, lectotype here designated), hom. illeg. pro *T. pauciflora* (Baker) Klatt, Abh. nat. Ges. Halle 15: 358. 1882. (syn. *Gladiolus floribundus* Jacq.).

Hesperantha burtonii L. Bol. ms., *L. Bolus s.n.* (BOL 21241, K, PRE, SAM).

Hesperantha marlothii Schltr. ms., *Marloth 7643* (PRE), 7657 (B).

Plants (40–)100–180(–250) mm high. *Corm* ca. 10 mm in diameter at base, symmetric, campanulate, tunics imbricate, older layers accumulating above, black, woody, entire, basal margin usually bearing radiating spiny projections. *Cataphyll* apparently lacking. *Leaves* 3–5, basal, half to two-thirds the height of whole plant, ensiform-oblong, obtuse-subacute (3–)5–6 mm wide, margin hyaline, occasionally slightly raised, uppermost leaf largest, conspicuously sheathing lower two-thirds of stem, and monofacial towards apex only. *Stem* erect, single, or 1–2-branched from near base. *Spike* flexuose, (1–)2–4-flowered; *bracts* membranous, pale green to transparent, often red-flushed and dry at apices, 9–14 mm long; inner narrower, about as long. *Flower* hypocrateriform, pink to reddish-purple, darker on reverse of outer tepals (when dry, inner tepals fade more rapidly and seem pale); *perianth tube* 6–11 mm long, cylindrical; *tepals* unequal, spreading, outer larger, 18–23(26) mm long, narrowly elliptic, 7–9 mm at widest. *Filaments* 2.5–7 mm long; *anthers* 5.5–9 mm, usually longer than filaments, occasionally as long. *Ovary* 2.5–4 mm, style branches 9–15 mm long. *Capsule* ovoid, 5–10 mm long. *Chromosome number* $2n = 26$ (*Goldblatt s.n.*—no voucher, Welkom, Kamiesberg; *Goldblatt 231*).

Flowering time: late August–September (early October at high altitudes).

Distribution: local in Namaqualand, especially in the Kamiesberg, and on the Nieuwoudtville escarpment; mainly in seasonally waterlogged sandy soils. Fig. 26.

Hesperantha pauciflora is an attractive, large red-purple to pink-flowered species of sandy to light clay soils in Namaqualand and the Nieuwoudtville escarpment. It is most common in fairly shallow, waterlogged sand, close to the edge of the Nieuwoudtville escarpment amongst Restionaceae and other fynbos species. It grows in similar wet sandy conditions in the Kamiesberg, and elsewhere in Namaqualand, but also occurs on heavier clay soil around Nieuwoudtville, on the edge of the Karoo in much drier conditions and in a renosterbos plant community. Plants vary considerably in size, depending on seasonal rainfall and soil depth, and in especially shallow or stony soils plants may be only 40–50 mm tall, while nearby, in deeper soil, individuals may reach 250 mm. The daily timing of flowering is fairly precise: flowers open at about midday, earlier in hot weather and later in cold conditions; and close between 16h00 and 16h30. *Hesperantha pauciflora* is sympatric with *H. marlothii*, an evening-blooming species, along the Nieuwoudtville escarpment, while further east around the town of Nieuwoudtville, it is sympatric with *H. cucullata*, *H. radiata* and *H. bachmannii*, all evening-blooming, and the blue-flowered form of *H. pilosa*, the flowers of which open at daybreak and close at about midday. Locally, *H. vaginata* can occur alongside *H. pauciflora*, but *H. vaginata* prefers deeper, richer clay soils and is not truly sympatric. This concentration of species of *Hesperantha* essentially in the same community, and with overlapping flowering times, is remarkable. No interspecific hybrids have been recorded between any of the species and it can be assumed that differences in daily flowering time, or different flower shapes or scents discourage pollinators from straying from single species.

Hesperantha pauciflora appears to be related to the *H. falcata* complex, and is in fact very similar to this species. The corms are typical of section *Hesperantha*, being campanulate in shape with a flat side, and basal margins sometimes bearing short thick spines. It is closely allied to the Kamiesberg endemic, *H. latifolia*, and the two almost certainly share a common ancestor. *Hesperantha latifolia* is the more specialised, having a long perianth tube, and a short, sometimes entirely subterranean stem. This species grows in shallow seasonal pools or thin layers of waterlogged sand in granite outcrops, while *H. pauciflora* always grows in deeper and better drained soils.

When first described, the species was assigned to *Tritonia* as *T. pauciflora* (Baker, 1892), and it is an illegitimate homonym for *T. pauciflora* (Baker)



FIG. 26.

Morphology and distribution of *Hesperantha pauciflora* (above) and *H. latifolia* (below). Habits $\times 0,5$; flowers life-size (vouchers: *H. pauciflora* Goldblatt 3953, Nieuwoudtville; *H. latifolia* Goldblatt 5760, Kamiesberg).

Klatt. This latter species is a synonym of *Gladiolus floribundus* Jacq. (Lewis *et al.*, 1972). *Hesperantha pauciflora* is thus treated as a new name dating from 1938 when Lewis assigned it to this genus.

SOUTH AFRICA, CAPE—2917 (Springbok): 5,3 km south of Kosies house on Kosies Rabas road (-BA), van Berkel 398 (MO).
—3017 (Hondeklipbaai): Grootvlei (-BB), Lewis 4336 (SAM), Lewis 5219 (NBG),

Barker 3736 (NBG), 8406 (NBG), *Acocks* 19465 (K, NBG, PRE); Grootvlei valley, *Compton* 6610 (NBG).

—3018 (Kamiesberg): Near Naries, Kamiesberg (-AC), *H. Bolus* 6222 (BOL); Bailley's vlakte, wet ground, *Pearson* 6611 (BOL, SAM); Top of Studers Pass, Kamiesberg, *Goldblatt* 4046 (MO); Leliefontein, *Rodin* 1454 (BOL, K, UC), *Goldblatt* 5766 (B, MO, PRE, S, US, WAG); Welkom, sandy flats, *Oliver* 3530 (K, MO, PRE); Garies-Bitterfontein (-C), *Leipoldt* 3871 (BOL).

—3119 (Calvinia): Nieuwoudtville (-AC), *Watermeyer s.n.* sub *Marloth* 5567 (PRE), *Buhr s.n.* (BOL, STE 25428), *Loubser* 941 (NBG), *Compton* 20886 (NBG), *L. Bolus s.n.* (BOL 21241, K, PRE, SAM), *Goldblatt* 231 (BOL); 5 miles E of Nieuwoudtville, *Lewis* 2286 (SAM, PRE), *Barker* 6535 (NBG); Near Grasberg, NW of Nieuwoudtville, *Lewis* 5830 (NBG), 5848 (NBG, STE), *Goldblatt* 274 (BOL); Glenlyon farm, *Goldblatt* 3953 (MO, PRE, US, WAG); Willemsrivier, Nieuwoudtville, *Leipoldt* 814 (SAM); Uitkomst, SW of Nieuwoudtville, *Barker* 6535 (NBG), 10741 (NBG); Oorlogskloof, sand near river, *Leipoldt* 798 (SAM); Papelfontein hills, *Schlechter* 10904 (B, BOL, G, GRA, K, L, MO, PH, PRE, US, Z); Van Rhyns Pass, flats, *Diels* 606 (B); W of Nieuwoudtville, *Marloth* 7657 (B, PRE); Top of Van Rhyns Pass, *Oliver* 3848 (K, MO, PRE, S, STE), *Goldblatt* 3073 (MO, S); Cloudskraal road, Nieuwoudtville plateau, *Goldblatt* 6220 (MO).

Without precise locality: Namaqualand Minor, *Scully* 88 (BOL, Z).

27. *Hesperantha latifolia* (Klatt) De Vos, Jl S. Afr. Bot. 40: 252. 1974.

Fig. 26.

Syringodea latifolia Klatt, Abh. nat. Ges. Halle 15: 403 (Ergänz. 69). 1882; Baker, Flora Cap. 6: 36. 1896. Type: S. Africa, Cape, am Ellenboogsfonteinberg, *Drège* 2633 (B, lectotype; P, S, isolectotypes).

Hesperantha pearsonii Foster, Contr. Gray Herb. 166: 21. 1948. Type: S. Africa, Cape, Namaqualand, Khamsop Ravine, *Pearson* 6539 (B, holotype; MO, isotype).

Plants (40–)60–100(–180) mm high. *Corm* ca. 10 mm in diameter at base, symmetric, campanulate with a flat base, tunics black, woody, entire, basal margin usually with radiating spiny projections. *Cataphyll* evidently lacking. *Leaves* 3–5, basal, falcate or erect and then reaching to top of spike, ensiform-oblong, obtuse to acute (1–3–)4–7 mm wide, margin hyaline, uppermost leaf often largest, sheathing stem entirely or in lower part. *Stem* underground or more often short and aerial, erect, single or 2–3-branched from near base. *Spike* straight, 1–3-flowered; *bracts* membranous, pale green to transparent, often red-flushed and dry at apices. (6–)10–15(–20) mm long, inner narrower, slightly shorter. *Flower* hypocrateriform, deep pink to purple, darker on reverse of outer tepals; *perianth tube* 15–25 mm long, cylindric, slightly wider near apex; *tepals* unequal, outer somewhat larger, spreading, 15–23 mm long, narrowly elliptic, 4–9 mm at widest. *Filaments* (4–)7–10 mm long; *anthers* (4–)5.5–7 mm, equal to or shorter than the filaments. *Ovary* ca. 4 mm, style branches longer than the anthers. *Capsule* ovoid, 6–10 mm long. *Chromosome number* $2n = 26$ (*Goldblatt* 5760).

Flowering time: August–September.

Distribution: restricted to the Kamiesberg, in Namaqualand, in shallow pools and thin damp sand overlying rock. Fig. 26.

Hesperantha latifolia is an endemic of the Kamiesberg massif in central Namaqualand, where it occurs above 1 000 metres. It grows in a very distinctive habitat, shallow seasonal pools, or in damp sand or moss overlying flat or concave rock shelves. Plants growing in favoured situations are tall, with produced aerial stems and have up to three flowers, while those in more extreme sites, or in dry seasons, are dwarfed, with narrow leaves, no produced stem, and one or two flowers.

The dwarfed plants match exactly the type collection made by Drège in the 1820's. Similar gatherings of entirely dwarfed individuals are few (e.g. *Stokoe s.n.* in SAM). More often collections consist of plants ranging in size (Hutchinson 878, Schlechter 11221, Goldblatt 5769) or entirely of quite large specimens as in the type gathering of *Hesperantha pearsonii* (Pearson 6539). *Hesperantha latifolia* was first described as a species of *Syringodea*, owing to its long, slender perianth tube and lack of an aerial stem. When the type, Drège 2633 in the Paris Herbarium, was examined by Dr. M. P. de Vos, during her study of *Syringodea*, she found the style and style branches typical of *Hesperantha* (De Vos, 1974). In the latter genus the broad, equitant leaves are of course quite typical, and in fact the leaves of the type form of *H. latifolia* are not unusual for the genus.

Hesperantha latifolia, particularly larger individuals, closely resembles the more widespread *H. pauciflora*, and the two species are certainly closely allied. Both species occur in the Kamiesberg, often in close proximity. *H. pauciflora* however, generally grows in deep sandy soil, often seasonally waterlogged, while *H. latifolia* is restricted to rocky sites with shallow wet soil, or rock pools. *H. latifolia* is readily recognised by its deep pink colour and long perianth tube, well exerted from the floral bracts. It differs in the latter character from *H. pauciflora* which has a short tube, usually shorter than the bracts, as well as in several minor technical characters. These include leaves as long as the spikes, anthers usually rather shorter than in *H. pauciflora*, and equal to or shorter than the filaments.

SOUTH AFRICA, CAPE—3017 (Hondeklipbaai): “am Ellenboogsfonteinberg” (now Boesmanskop) (-BB), Drège 2633 (B, P).

—3018 (Kamiesberg): Near Kamieskroon (ΓAus) (-AC), Schlechter 11221 (B, PRE); Khamsoap ravine, Pearson 6539 (B, MO); Naras ravine, wet sand, Pearson 6533 (BOL, SAM); Below top of Studers Pass, mossy damp rocks, Thompson 216 (STE); E slopes of Rooiberg near Welkom, Goldblatt 4058 (MO), Goldblatt 5760 (B, K, MO, NBG, PRE, S, US, WAG); am Modderfonteinberg, Drège 8488 (G, P, S); Sneekop, Kamiesberg, Hutchinson 878 (BOL, K).

Without precise locality: Namaqualand, 1929, *Stokoe* 6162 (BOL, SAM).

28. *Hesperantha luticola* Goldbl., sp. nov. Fig. 27.

Plantae 50–100 mm altae, *cormo* campanulato, spinoso, *foliis* 4–5, basilibus, 50–100 mm longis, *spicis* reductis, 1–2 floribus, *bracteis* 17–20 mm longis, membranaceis, *floribus* hypocrateriformibus, albis purpureis maculatis ad basem tepalorum, *tubo perianthii* (15–)30–45 mm longo, *tepals* 10–15 mm longis, *filamentis* 3 mm longis, *antheris* 3–5 mm longis.

Type: S. Africa, Cape, farm Knecht's Bank, E of Swartberg, between Middelpoos and Calvinia, Thompson 2529 (STE, holotype; PRE, isotype).

Plants small, 50–100 mm high, including leaves. *Corm* more or less campanulate, symmetric, with a flat base, tunics black, V-notched on basal margin of outer layers, basal margins with projecting teeth. *Cataphyll* solitary membranous. *Leaves* 4–5, basal, equitant, straight to slightly falcate, 50–100 mm long. *Stem* entirely underground, and concealed by leaf bases. *Spike* reduced, 1–2-flowered; *bracts* membranous, pale, 17–20 mm long, concealed by leaf bases, inner smaller than outer. *Flower* hypocrateriform, white, with purple blotches at base of inner tepals, outer tepals lilac on reverse; *perianth tube* (15–)30–45 mm long, cylindrical; *tepals* spreading, outer 10–15 mm long, lanceolate, 4–6 mm wide, obovate, inner 10–13 mm. *Filaments* 3 mm long; *anthers* 3–5 mm, erect. Ovary ca. 4 mm long, style branches ca. 12 mm, spreading horizontally. *Capsule* oblong, (10–)15–25 mm long. *Chromosome number* $2n = 26 + 2B$ (Goldblatt 5814).

Flowering time: July–August.

Distribution: seasonal wet depressions and pools on the Roggeveld escarpment and on the Hantamsberg above Calvinia. Fig. 27.

This distinctive, long-tubed species was barely known until the last decade when collections were made by W. F. Barker and M. Thompson independently and then subsequently by myself. Despite the few collections over a distance extending some 120 km from the Hantamsberg at Calvinia to near Sutherland, *Hesperantha luticola* is fairly common and can be found frequently in suitably moist habitats such as seasonal pools and seeps, wet in the winter and spring. It flowers unusually early in this area of cold winters, usually in July, when much of the other vegetation is still in the early stages of growth and it is usually overlooked in fruit, two months later, when most collecting is done in the western Karoo. The reduced acaulescent growth form of *Hesperantha luticola* is paralleled in several other western Karoo species, notably *H. humilis* and *H. hantamensis*, but it is apparently unrelated to these species which have globose, asymmetric corms with imbricate tunics, and clearly belong in section *Imbricata*. *Hesperantha luticola* has campanulate corms with a large, often oblique flat side, from the margins of



FIG. 27.

Morphology and distribution of *Hesperantha luticola*. Habit $\times 0,5$; flower life-size (voucher Goldblatt 6067, west of Middelpos).

which short spikes project. The corm is most like that found in section *Hesperantha*, especially *H. pauciflora* and *H. latifolia*, both Namaqualand species, and it is to these that it is most probably related.

SOUTH AFRICA, CAPE—3119 (Calvinia): Hantamsberg, Calvinia, summit plateau (-BD), damp hollow, *Thompson 2344* (PRE, STE).

—3120 (Williston): Blomfontein farm, W of Middelpos (-CC), *Barker 10772* (NBG), *Goldblatt 5814* (K, MO); 60 km SE of Calvinia, on road to Middelpos via Blomfontein, *Goldblatt 6067* (K, MO, NBG, S, US); E of Swartberg, farm Knechts Bank, temporary pool, *Thompson 2529* (PRE, STE).

—3220 (Sutherland): Roggeveld, Quaggasfontein road, beyond Agterplaas, near Uitkyk, 4700 ft (-AB), *Goldblatt 6350* (MO); Sneekrans Mt., 4500 ft, S of Voëlfontein farmstead (-AD), *Goldblatt 6340* (MO, NBG).

29. *Hesperantha spicata* (Burm.f.) N.E. Br., Kew Bull. 1929: 136; Foster, Contr. Gray Herb. 166: 25. 1941. Fig. 28.

Ixia spicata Burm.f., Prod. Fl. Cap. 1. 1768. Type: S. Africa, Cape, probably cultivated in Holland, *Burman s.n.* (Herb. Burman, G, holotype).

Plants 120–300(–500) mm high, slender. Corm more or less campanulate to conic, flat based, 10–15 mm in diameter at base, tunics of entire, brittle,

subwoody layers, outer layers sometimes irregularly broken, lower margin of each layer often somewhat fringed, or irregularly split. *Cataphyll* usually solitary or apparently lacking. *Leaves* usually three, lower two erect and linear or fistulose, or falcate and often crisped, upper sheathing for most of its length. *Stem* erect, always simple, with one or sometimes two short, sheathing bract leaves. *Spike* erect, remote from leaves, 4–20-flowered; *bracts* 5–7(–9) mm long, outer green, often red-tipped, inner more or less equal, sometimes slightly longer, membranous with two green veins, apically bifurcate. *Flower* stellate, white, secund, reverse of outer tepals brownish-purple; *perianth tube* cylindrical, ca. 4 mm long in newly opened flowers, sometimes reaching 6 mm later; *tepals* subequal, narrowly ovate, 4–7(–9) mm long. *Filaments* ca. 2 mm long; *anthers* articulated, 3.5–4.5 mm long. *Ovary* ca. 2 mm long, style branches ca. 3 mm. *Capsule* 7–9 mm long, obovoid, longer than bracts. *Chromosome number* $2n = 26$ (subsp. *graminifolia* only, *Goldblatt* 416, 5263).

Flowering time: August–September(–October).

Distribution: western Cape, from the Peninsula north to the Piketberg and Porterville Mountains, and east to French Hoek and Wolseley. Fig. 28.

Hesperantha spicata is a distinctive, small-flowered species typically with long secund spikes of up to 20 flowers, and flat-sided, campanulate corms. It is restricted in range to hills and flats of the western Cape coastal belt, with limited extensions into the valleys interior to the mountain ranges that run parallel to the west coast from Gordons Bay north to Porterville. The vegetative morphology is unusually variable, leaves ranging in form from linear to falcate to terete and fistulose, and with margins plane to undulate or crisped. Plants with different leaf types have been described as distinct species. These differences in leaf morphology are accompanied by little or no floral variation and the extremes are linked by intermediates so that recognition based solely on leaf morphology seems unnecessary, and the three species and one variety recognised by Foster (1948) are reduced here to three subspecies. Details of differences between the subspecies are discussed following their descriptions.

KEY TO THE SUBSPECIES

1. Basal leaves *Juncus*-like, terete and hollow, no mid-vein evident 3. subsp. **fistulosa**
- 1'. Basal leaves flat, monofacial, with mid-vein well developed.
 2. Non-sheathing basal leaves firm-textured, erect or falcate, margins crisped (less often plane) 1. subsp. **spicata**
 2. Non-sheathing basal leaves soft-textured, erect, narrow, margins plane 2. subsp. **graminifolia**

1. subspecies *spicata*. Fig. 28B and C.

Hesperantha cinnamomea (L.f.) Ker, König & Sims, Ann. Bot. 1: 225. 180.

Ixia cinnamomea L.f. Suppl. Pl. 92. 1782. Type: S. Africa, Cape, "in colibus Leuwestaart", Thunberg s.n. (Herb. Thunb. 937 UPS, lectotype; S, isotype).

Hesperantha spicata var. *cinnamomea* (L.f.) Foster, Contr. Gray. Herb. 166: 25. 1948.

Plants 120–300 mm high. Leaves erect to falcate, often with distinct hyaline marginal ridge, margins plane, or more often crisped, 50–150 mm long, 50–80 mm at widest. Spike with 5–12(–17) flowers, bracts 5–7 mm long. Tepals 4–7 mm long. Chromosome number unknown.

Distribution: stony and clayey soils, from the Piketberg Mountains in the north, to drier parts of the Cape Peninsula, and inland near Wolseley. Fig. 28.

The type specimen of *Hesperantha spicata* is a robust plant with broad, erect, straight-margined leaves of firm texture and is very different from the type of *H. cinnamomea* which has crisped, short falcate leaves. The two represent the extremes of the range of form found in subspecies *spicata* and they are linked by a large number of intermediate forms. Occasionally almost the whole range of leaf types can be found in a single collection, e.g. Goldblatt 5774 from Piketberg. There seems little reason to give taxonomic recognition to the form typified by *H. cinnamomea*, although Foster (1948) acknowledged it as a variety of *H. spicata*.

SOUTH AFRICA, CAPE—3218 (Clanwilliam): Flats N of Piketberg, at foot of Zebra Kop (-DB), Goldblatt 6130 (MO); Witte Water, 10 miles W of Piketberg (-DC), Lewis 2004 (SAM); Near Berg R. bridge, L. Bolus & Lewis s.n. (BOL); Near top of Versveld Pass, Piketberg, Goldblatt 5774 (K, MO, NBG, PRE, S).

—3318 (Cape Town): Klipberg, Darling (-AD), Bachmann 1176 (B); Darling, Bachmann 285 (B); Malmesburg–Hopefield (-A-B), Salter s.n. (BOL 31529); Near Moorsburg, shale hills (-BA), Acocks 24397 (PRE); Signal Hill, slopes (-CD), Penfold s.n. (SAM 52896); Above Tamboers Kloof, Michell s.n. (NBG); Kloof, Lion's Head, Diels 68 (B); Slopes of Lion's Head, Drège s.n. (SAM), Lewis 1084 (SAM); Above Sea Point, Guthrie s.n. (BOL 16644); Lion's Back, Wolley Dod 584 (BOL, K); Löwenrücken, Ecklon s.n. (K, S); Leeuwestaart, Pappe s.n. (1835) (S); Rosebank, Cape Town, H. Bolus s.n. (BOL 3768, GRA, K); Wellington (-DB), Loubser 932 (NBG); Farm Paarl Diamant, Paarl distr., Acocks 24415 (K, PRE); Langverwacht, above Kuils River (-DC), Oliver 4326 (K, MO, PRE, S, STE).

—3319 (Worcester): Piketberg Road (Gouda) (-AC), Schlechter 10711 (B), 4852 (B, G, GRA, K, WU, Z); Botha's Halt, Gillett 253 (STE).

—6418 (Simonstown): Hottentots Holland (-BB), Drège s.n. (SAM).

Without precise locality: Cape of Good Hope, Bergius 466 (B); Siebold 575 (B); Link 1199 (B); Verreaux 1831 (G); Roxburgh s.n. (G); Thunberg s.n. (S, UPS).

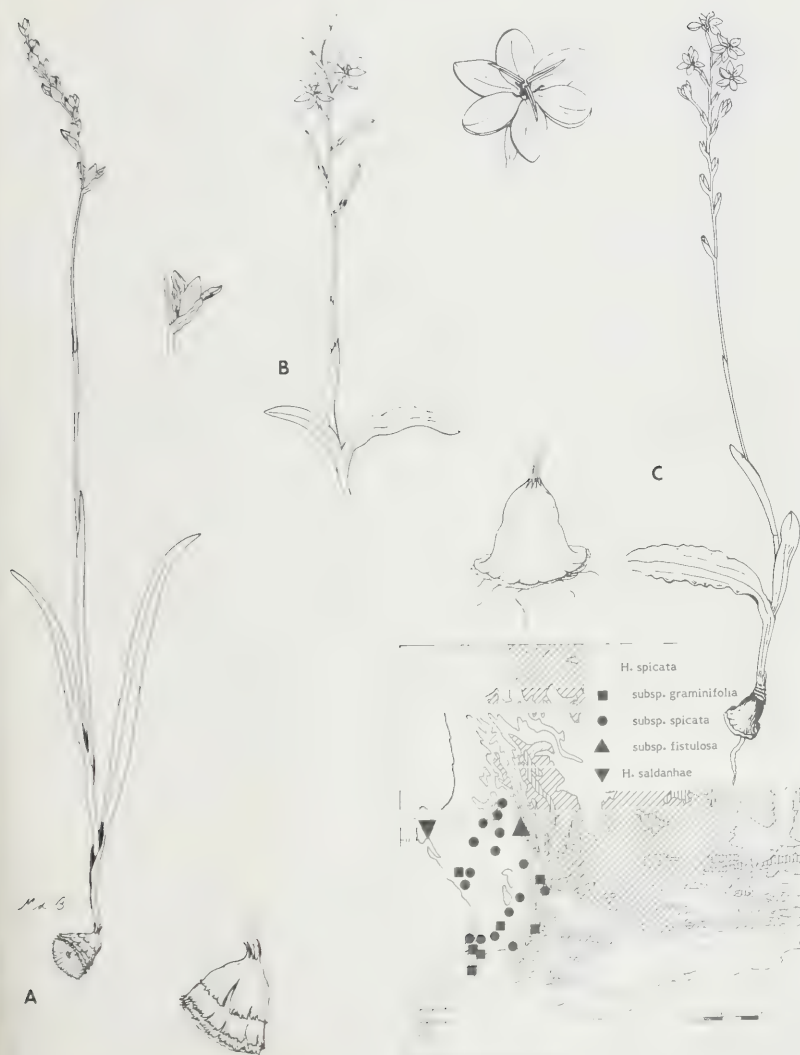


FIG. 28.

Morphology of *Hesperantha spicata* and distribution of *H. spicata* and *H. saldanhae*. A: *H. spicata* subsp. *graminifolia*; B and C: *H. spicata* subsp. *spicata*. Habits $\times 0.5$; fruit and corms life-size; flower $\times 2$ (vouchers A: Goldblatt 5023, Cape Point; B: Goldblatt 6130, foot of Zebrakop; C: Goldblatt 5774, Piketberg).

2. subspecies **graminifolia** (Sweet) Goldbl., comb. nov. et stat. nov.
Fig. 22A.

Hesperanthes graminifolia Sweet Hort. Suburb. Lond. 9. 1818 & Hort. Brit. ed. 2., 503. 1830; Baker, Flora Cap. 6: 59. 1896; Foster Contr. Gray Herb. 166: 14. 1948. Type: illustration of *H. pilosa* var. β , Bot. Mag. tab. 1254. 1810 (lectotype).

Plants (150–)200–500 mm high. *Leaves* three, occasionally two, 70–150 mm long, comparatively soft in texture, straight, rarely slightly falcate, linear-lanceolate, 2–5(–8) mm wide, margins plane, lower two basal, upper basal or inserted shortly above ground and sheathing, with a short free apex. *Spike* (4–)9–20-flowered; *bracts* 5–8 mm long. *Tepals* 5–8(–9) mm long. *Chromosome number* $2n = 26$ (Goldblatt 5263, 416 as *H. spicata*).

Flowering time: (August–)mid September–October.

Distribution: mainly on sandy soils, common on the Cape Peninsula but extending north to Darling and east to the French Hoek Mountains. Fig. 28.

Subspecies *graminifolia* shares with the typical subspecies all features except for its characteristically narrow, soft-textured, erect leaves with plane margins. Some populations are intermediate in leaf character between subsp. *graminifolia* and subsp. *spicata*. Salter s.n. (BOL 31529, Hopefield–Malmesbury) has the narrow erect leaves of subsp. *graminifolia*, but slight crisping of the margins; Tyson 1540 from Kluitjieskraal near Wolseley (Ceres Road) consists of plants some of which have short, falcate leaves and others with longer, erect leaves; and a collection from Versveld Pass, Piketberg (Goldblatt 5774) of mainly short, crisped leafed plants contains several individuals with longer leaves with plane margins. Naming such collections to subspecies becomes arbitrary. This subspecies is most common on the Cape Peninsula where it occurs on sandy soils. It flowers profusely after summer fires and seldom at other times.

SOUTH AFRICA, CAPE—3318 (Cape Town): Versfeld Nature Reserve, Darling (-AC), Goldblatt 461 (BOL); Darling Flora Reserve (-AD), Barker 8650 (NBG), Lewis 5072 (NBG); Burnt slopes above Window Gorge, Table Mt. (-CD), Esterhuysen 11229 (BOL); Burnt slopes, Nursery Gorge, Kirstenbosch, Esterhuysen 11715 (BOL, K); Cecilia, 1000 ft., Barker 4285 (NBG); Kenilworth Race Course, Lewis 58 (SAM), Barker 4800 (NBG); Kenilworth, *H. Bolus* s.n. (BOL 7246, K), (BOL 8026), (BOL 3768 in PRE); Wynberg, Zeyher 429 (SAM), Schlechter 1564 (B, GRA, Z); Camps Bay, Zeyher 141 (PRE, SAM), Cassidy 39 (NBG); Foot of Table Mt., near town, MacOwan 2386 (K, S, SAM, WU); Lion Rump, Thode 7774 (STE); Hercules Pillar (-DD), Compton 13687 (NBG).
 —3319 (Worcester): Ceres Road (Wolseley), sandy sites (-AC), Tyson 2958 (SAM); Kluitjies Kraal, S of Wolseley, Tyson 1540 (B, G, K, SAM, Z); Sandy flats, Romans River Nature Reserve, Goldblatt 6289 (MO); French Hoek Pass, 1500 ft (-CC), Barker 5337 (NBG).

—3418 (Simonstown): Mountains around Simonstown (-AB), *H. Bolus s.n.* (BOL 4690, K); Kalk Bay Mt., *Barker* 4227 (NBG); Near Paulsberg, Cape Peninsula (-AD), *Lewis* 1596 (SAM); W slopes of Klaasjagersberg, opposite Cape Point Reserve, *Goldblatt* 5263 (K, MO, NBG, PRE, S, WAG); Stony N facing slope between Fish Hoek and Sun Valley, *Goldblatt* 5920 (MO).

3. subspecies ***fistulosa*** (Baker) Goldbl., comb. nov. et stat. nov.

Hesperantha fistulosa Baker, Bull. Herb. Boiss. sér 2, 4: 1004. 1904; Foster, Contr. Gray Herb. 166: 11–12. 1948. Type: S. Africa, Cape, near Porterville, *Schlechter* 4885 [G, lectotype designated by Foster (1948: 12), B, BOL, G, GRA, K, SAM, WU, Z, isolectotypes].

Plants 150–200 mm high. *Leaves* 40–80 mm long, fistulose, terete when live, ca. 2 mm in diameter, and evidently without a central vein. *Spike* with 4–9 flowers; *bracts* 5–6 mm long. *Tepals* (4–)5–6 mm long. *Chromosome number* unknown.

Distribution: local in the Porterville district. Fig. 22.

Subspecies *fistulosa* is readily recognised by its slender, fistulose leaves, but in all other characters it is virtually identical to the other subspecies of *H. spicata*. Its flowers and bracts are generally rather small but fit well within the range of the species. It is restricted to the Porterville area, growing where I have seen it, on damp clay soil.

SOUTH AFRICA, CAPE—3318 (Cape Town): Near Porterville (-BB), *Schlechter* 4885 (B, BOL, G, GRA, K, SAM, WU, Z), 10731 (B, BOL, GRA), 2567 (PRE); Porterville, *Schlechter* 2567 (PRE); Porterville–Twenty Four Rivers, *Goldblatt* 3921 (K, MO, NBG).

30. ***Hesperantha saldanhae*** Goldbl., sp. nov.

Plantae 150–250 mm altae, *cormo* 10–12 mm in diametro, campanulato, tunicis imbricatis, *foliis* 3, basalibus vel superiore supra terram inserto, 5–6 mm latis, *spicis* 5–8 floribus, *bracteis* 7–10 mm longis, acutis, *floribus* ?hypocrateriformibus, albis, *tubo perianthii* ca. 9 mm longo, *tepals* 9–10 mm longis, *filamentis* brevibus, 1 mm longis, *antheris* 2–3 mm longis, *ramic styli* 4 mm longis, in tubo divisus et apicibus vix emergentibus.

Type: S. Africa, Cape, granite rocks at Vredenburg, *Lewis* 5977 (NBG, holotype).

Plants 150–250 mm high. *Corm* campanulate, symmetrical, 10–12 mm at widest point, base flat, tunics brown, woody, entire, or outer layers fragmented irregularly at places, basal margins irregularly fringed. *Cataphyll*

solitary, membranous. *Leaves* 3, lower 2 or all 3 basal, lower two about one-third the length of the stem, ensiform, one partly sheathing the stem, 5–6 mm wide, third leaf sheathing lower half of stem with short free apex. *Stem* erect, simple, bearing a short and entirely sheathing bract in upper half. *Spike* straight, secund, 5–8-flowered; *bracts* 7–10 mm long, herbaceous, inner narrower, but often slightly longer than outer. *Flower* evidently white, facing laterally, ?hypocrateriform; *perianth tube* ca. 9 mm long initially, later reaching 12 mm and becoming well exerted from bracts and twice as long; *tepals* 9–10 mm long, ?outspread, narrowly ovoid, 4–5 mm wide. *Filaments* 1 mm long; *anthers* 2–3 mm long. Ovary 2–3 mm long; style dividing in the tube, branches 4 mm long, apices just emerging to reach base of anthers. *Capsule* unknown. *Chromosome number* unknown.

Flowering time: August.

Distribution: known only from the Saldanha Bay area near Vredenburg, among granite rocks. Fig. 28.

This species resembles closely *Hesperantha spicata* especially subspecies *graminifolia*, to which it was referred, as *H. graminifolia*, by G. J. Lewis who made the only known collection. The resemblance is striking and the species have the same general appearance, corm, and secund inflorescence with small flowers. A careful examination of the flowers, however, reveals rather sharp differences. The perianth tube is unusually long for *H. spicata*, about twice the length usual for that species while the anthers are very short, ca. 2–3 mm long, and almost sessile, on filaments about 1 mm long. In addition, the style divides well inside the perianth tube, and the branches just emerge from the mouth of the tube, reaching the base of the anthers. These differences are well beyond the range of variation found in *H. spicata*, with its comparatively short tube, long anthers and well exerted style branches, and compel the recognition of *H. saldanhae* as a distinct species, closely allied to *H. spicata*.

SOUTH AFRICA, CAPE—3217 (Vredenburg): Among granite rocks, Vredenburg (-DD), *Lewis* 5977 (NBG).

Section RADIATA

4. Section **Radiata** Goldbl., Ann. Missouri Bot. Gard. **69**: 377. 1982.

Corm either \pm asymmetric with one side flattened below or symmetric and campanulate in outline, tunics imbricate, outer covering inner only above, unbroken, or notched regularly below into sections, these sometimes \pm ciliate-edged, occasionally lower margins of layers serrate to spiny. Outer

bract margins usually united below around the axis, sometimes for over half their length. Flower \pm actinomorphic, but usually with curved perianth tube (straight in *H. juncifolia* and barely curved in *H. brevifolia*) and pendulous, unilateral anthers, white-cream, or pale to deep pink, tube well exerted from bracts in some species.

Distribution: widespread in southern Africa: Namaqualand to Malawi.

Species: ca. 8, 5 in the winter rainfall area.

Type species: H. radiata (Jacq.) Ker

Section *Radiata* comprises a close-knit group of seven to nine species centred around the *H. radiata*–*H. tysonii* complex. This complex extends from Namaqualand through the south western Cape and Karoo into eastern southern Africa as far as Swaziland. Corm tunics vary to an unusual extent even within *H. radiata* sensu stricto, but the characteristic bracts usually with united margins, flowers with curved perianth tubes, and several, small leaves unite the section. There are several local endemics in the south western Cape including the terete-leafed *H. juncifolia* from limestone areas of the Bredasdorp coast; the deep pink-flowered *H. elsiae* from the Cedarberg, which has included stamens and style branches; and the very large-flowered *H. muirii* from the Riversdale district. *Hesperantha marlothii*, centred in the Roggeveld, has flat-sided corms with spiny margins and it, as well as the south western Cape *H. brevifolia*, have bracts in which the margins are barely fused. Section *Radiata* extends into Botswana, Zimbabwe and Malawi where the long-tubed *H. longicollis* and dwarf *H. ballii* occur.

31. *Hesperantha brevifolia* Goldbl., sp. nov. Fig. 29.

Plantae (100–)150–400 mm altae, *cormo* ad 5 mm in diametro, conico, *tunicis* imbricatis, *foliis* 3–5, inferioribus 1–3 basalibus, 2–3 mm latis, brevibus, *spicis* 2–5 floribus, *bracteis* 10–14 mm longis, percostatis, *floribus* \pm secundis, albis, rubris dorso tepalis exterioribus, *tubo perianthii* 6–8 mm longo, prope apicem curvato, *tepalis* 8–13 mm longis, *filamentis* brevibus, 3–5 mm longis, *antheris* 5–6 mm longis, dependentibus.

Type: S. Africa, Cape, Zebrakop. Piketberg Mts., S slopes at 4000–4500 ft. *Esterhuysen* 35320 (MO, holotype; B. BOL. BR. C. E. K. M. MO. NBG. P. PRE. S. US. WAG, isotypes).

Plants medium in size, (100–)150–400 mm high. *Corm* small, conic with an oblique flat base, to 5 mm at widest diameter, tunics imbricate, outer layers dark, accumulating above, innermost layer pale with conspicuous longitudinal ridges, lower margins flared outwards and minutely frayed. *Cata-*

phyll solitary, membranous, pale. *Leaves* 3–5, lower 1–3 basal, upper cauline, and partly sheathing, short, laminas 20–30 mm long, (1,5–)2–3 mm wide. *Stem* erect, with a leafy sheathing bract in upper half. *Spike* 2–5-flowered; *bracts* green, conspicuously veined, 10–14 mm long, amplexicaul, inner about as long as outer. *Flower* white, sometimes (sunnier sites) with red flush on reverse of outer tepals, second, with upper tepals tilted upwards, lower downwards; *perianth tube* 6–8 mm long, about as long as bracts or slightly longer, curved at apex only; *tepals* subequal, reflexed, 8–13 mm long, to 4 mm wide, obovate, upper held erect, lower flexed downwards. *Filaments* 3–5 mm long; *anthers* hanging downwards, 5–6 mm long.



FIG. 29.

Morphology and distribution of *Hesperantha brevifolia*. Habit $\times 0,5$; corm and flower life-size (voucher Esterhuysen 35320, Zebra kop, Piketberg).

Ovary ca. 3 mm long, style branches 40–50 mm long. Capsule 6–8 mm long, narrowly ovoid. *Chromosome number* $2n = 26$ (*Esterhuysen 35320*).

Flowering time: late October–late December.

Distribution: scattered in mountains of the western Cape, recorded only from the Piketberg Mountains, near Bains Kloof, Steendal near Tulbagh and above Wabooms River in the Hex River Mountains, in shallow soil, blooming profusely after fires. Fig. 29.

Hesperantha brevifolia is closely related to the widespread *H. radiata* and can easily be mistaken for this common species. Important differences are that although the bracts are united round the stem, the margins are not fused together, but free to their base; the several leaves are relatively broad but very short; the perianth tube is very short, barely emerging from the bracts; and the corms are very small and distinctive in having vertical ridges. It has only been recorded at four localities in the western Cape. The populations on Zebrakop in the Piketberg Mountains (*Esterhuysen 35320*) and near Bains Kloof (*Goldblatt 6840*) grew on S slopes at high elevations. Two other collections, from Steendal, near Tulbagh and above Wabooms River, are evidently from lower mountain slopes. Like many other members of the genus, *H. brevifolia* is night-blooming, flowers opening at about 18h00 and closing shortly after daybreak. The two high altitude collections were in bloom the year after a fire and it is likely that flowering in *H. brevifolia* is fire-induced.

The earliest known collection of this species dates from the Linnaean period, and consists of two plants in the herbarium at Geneva, mounted together with a single specimen of *Hesperantha spicata*, and a fragment of *H. bachmannii*. Label data suggest Roxburgh as the collector of the specimens of *H. brevifolia*, and Forster of *H. spicata*, but the information is confusing. The sheet in question is labelled *Ixia cinnamomea* and “Lin.-Wild” and it also has an annotation by Salisbury, according to a note by N. E. Brown, relating to the specimens of *H. brevifolia*.

SOUTH AFRICA, CAPE—3218 (Clanwilliam): Zebrakop, Piketberg, steep S facing slopes (-DB), *Esterhuysen 35320* (B, BOL, BR, C, E, K, M, MO, NBG, P, PRE, S, US, WAG); Zebrakop, *Linder 82* (BOL).

—3319 (Worcester): “Steindaal”, near Tulbagh (-AC), *Zeyher s.n.* (SAM 20819), Wabooms River, clayish hillside (-AD), *Esterhuysen 22255* (BOL, K); Slopes of the Limietberg, north of Bains Kloof, 3000 ft. (-CA), *Goldblatt 6840* (BOL, K, MO, NBG, PRE, S, US, WAG).

32. *Hesperantha radiata* (Jacq.) Ker. König & Sims Ann. bot. 1: 225. 1805; Baker, Handbk. Irid. 1892 & Flora Cap. 6: 64. 1896. Fig. 30.

Ixia radiata Jacq., Ic. Pl. Rar. 2: tab. 280. 1782 et Coll. Bot. Suppl. 15.

1796. Type: S. Africa, Cape, without locality, illustration in Jacq., Ic. Pl. Rar. 2: tab. 280. 1782.

Gladiolus recurvus L. sensu Thunb., Diss. *Gladiolus* no. 3, 1784.

H. radiata var. γ *caricina* Ker, Bot. Mag. sub tab. 573. 1802 et tab. 790. 1805. Type: S. Africa, Cape, without precise locality, illustration in Bot. Mag. tab. 790.

Hesperantha (as *Hesperanthus*) *tenuifolius* Salisb., Trans. Hort. Soc. 1: 321. 1812 nom. nov. pro *H. radiata* var. *caricina* Ker.

Hesperantha caricina (Ker) Klatt, Abh. nat. Ges. Halle. 15: 395 (Ergänz. 61) 1882.

Ixia fistulosa Andr., Bot. Rep. tab. 59. 1799, non Ker, 1801. Type: S. Africa, Cape, without locality, illustration in Bot. Rep. tab. 59.

Ixia recurva Vahl, Enumer. Pl. 2: 58. 1805 nom. illeg. superfl. pro *Ixia fistulosa* Andr.

Hesperantha angustifolia Ker ex Loudon, Fl. Gard. Orn. Bulb. Pl. 91. 1841. Type: S. Africa, Cape, without locality, illustration in Bot. Mag. tab. 790.

Hesperantha tysonii Baker, Handbk. Irid. 151. 1892 et Flora Cap. 6: 65. 1896. Type: S. Africa, Cape, near Kokstad, *Tyson 1585* (K, lectotype here designated; B, GRA, SAM, isotypes).

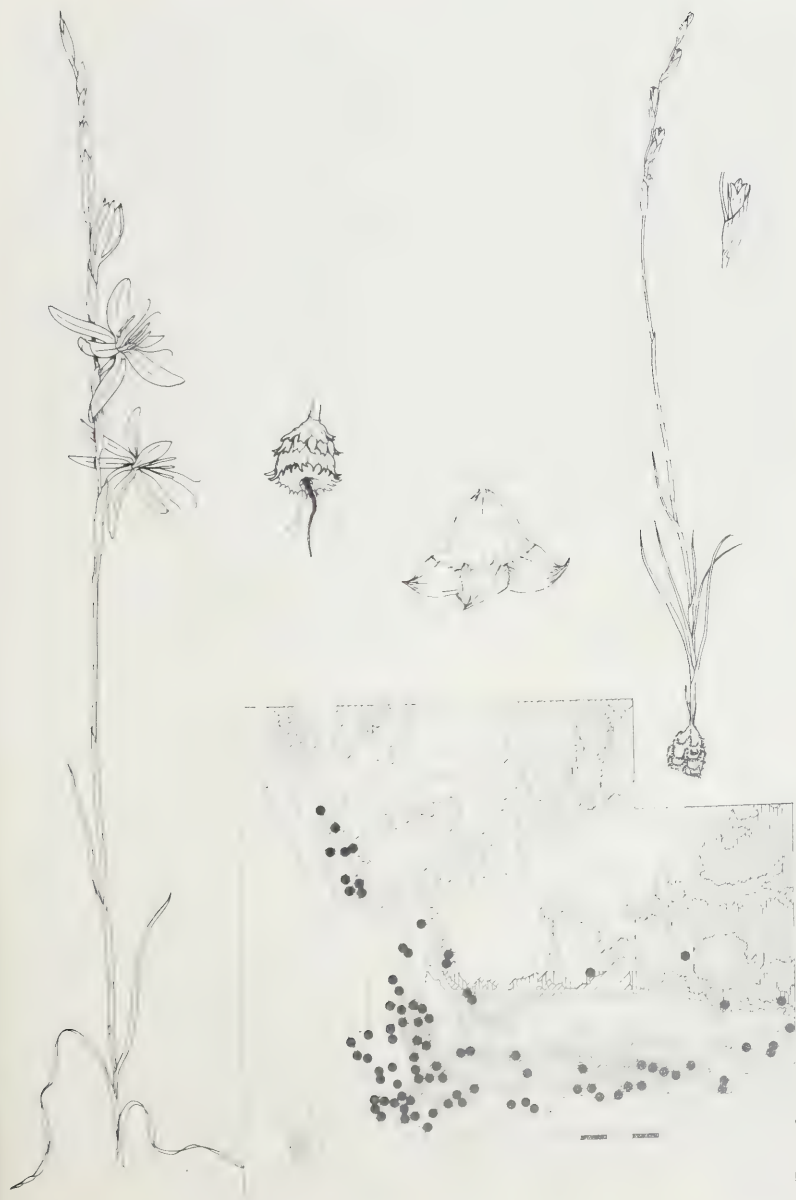
Hesperantha recurvata Asch. & Graebn., Syn. Mitteleur. Fl. 3: 540. 1906 nom. nov. pro *Gladiolus recurvus* L. sensu Thunb. Type: S. Africa, Cape, without precise locality, *Thunberg s.n.* (Herb. Thunb. 1059, UPS, lectotype; 1060, UPS, syntype).

Hesperantha setacea Ecklon ms., Ecklon & Zeyher Irid. 400, Irid. 233 etc., et Top. Verz. 23. 1827 nom. nud.

Plants medium to tall, (100–)200–600 mm high. *Corm* more or less campanulate and symmetrical, flat or oblique at base, 7–14 mm in diameter, occasionally the basal margin extending horizontally as a radiating fringe, or unevenly toothed, tunics brown to black, imbricate, outer layers accumulating over inner and with margins either unbroken or more often notched below, forming regular segments each with a minutely fringed to toothed margin, segments sometimes becoming concave with margins prominent, occasionally bearing 1–3 large cormlets at base. *Cataphyll* solitary, usually

FIG. 30.

Morphology and winter rainfall area distribution of *Hesperantha radiata*. Fruiting plant $\times 0.5$; flowering plant and enlarged capsule life-size; corms $\times 1.5$ (vouchers: flowering spike and left corm *Goldblatt 5138*, Cedarberg, Middelberg; middle corm *Goldblatt 4932*, near Humansdorp; fruiting material *Goldblatt 5179A*, Fernkloof Nature Reserve).



membranous and dry, or apparently lacking. *Leaves* usually 3 or 4, basal or inserted near ground level, the uppermost sheathing the stem for part of its length, linear, erect, usually ca. 2–3 mm wide, short, seldom reaching base of spike, often rather succulent or somewhat inflated when live, rarely falcate and up to 5 mm wide. *Stem* erect, unbranched, with 1–2 large entirely sheathing bract-leaves inserted in mid to upper half. *Spike* (1–)6–15-flowered, straight, secund; *bracts* 12–15(–20) mm long, imbricate in bud, outer sheathing the stem for at least half its length, inner bract equal or slightly longer. *Flower* recurved, and facing downwards, white-cream or greenish, usually with reddish-brown to purple on reverse of outer tepals; *perianth tube* 10–18 mm long, about as long as the bracts or slightly longer, curving towards apex of bracts; *tepals* 7–15(–17) mm long, slightly reflexed when fully open, narrowly ovate-lanceolate, to 5 mm wide, inner narrower than outer. *Filaments* ca. 3 mm long; *anthers* 4–7(–8) mm, usually pendent. Ovary 4–5 mm long, style branches 7–10 mm long. *Capsule* 10–18 mm long, narrow, 3–4 mm wide, upper part only emerging from bracts, and dehiscent in top one third. *Chromosome number* $2n = 26$ (Goldblatt 146; Goldblatt 6283; Goldblatt 5343).

Flowering time: August–October(–December at high altitudes in the western Cape), October–December in eastern southern Africa.

Distribution: throughout the winter rainfall area, from the Richtersveld to Port Elizabeth; in wet habitats in the arid north west coast, but in a variety of situations elsewhere (also in the eastern Karoo, and Drakensberg to Swaziland, where often treated as *H. tysonii*). Fig. 30.

Hesperantha radiata is one of the most widely distributed species of the genus, and when treated in a wide sense, as here, to include the eastern southern African *H. tysonii*, is unusual in occurring in both winter to summer rainfall areas of southern Africa. It extends from northern Namaqualand through the south western and southern Cape and along the mountain belt of eastern southern Africa to Swaziland. It is most common in the south western Cape, where it occurs on both sand and clay soils, and here exhibits its greatest variability, in height, flower size and corm morphology. In the winter rainfall area it occurs in a variety of habits, while in the drier parts of its range, in Namaqualand, it is usually found at higher altitudes or in wet sites near streams or seeps. In the western Cape it may be found at all elevations from coastal sand flats to clay lower mountain slopes, to sandy upper slopes, and is not limited to moist situations. According to Hilliard & Burt (pers. comm.), *H. tysonii* (the eastern form) is common in the Drakensberg along watercourses, seeps, bogs and other damp sites.

Throughout its range it is easily recognised by its unusual bracts which are united round the stem for at least half their length. Together with this

character are flowers with a curved perianth tube 10–18 mm long which usually slightly exceed the bracts.

Closely related to *Hesperantha radiata* are *H. longicollis*, a longer-tubed species of the Transvaal and Zimbabwe highveld, and the dwarf *H. ballii* of the Chimanimani Mountains of eastern Zimbabwe. In the western Karoo and north west Cape there is another close ally, *H. marlothii*, a low-growing species with spiny corms, which is common on the Nieuwoudtville and Roggeveld escarpments. In *H. marlothii*, which initially seems very like *H. radiata*, the bracts are united for only a short distance around the stem, and the plants are usually smaller and fewer flowered.

Hesperantha radiata exhibits an interesting range of corm morphology (Fig. 30). In the most common western Cape form the margins of the woody corm tunics are minutely fringed, and the lower part is divided into regular segments which become concave, thus elevating the segment margins. In several populations along the Cape west coast, and in the Cedarberg, the tunics tend to be irregularly serrated or even spiny. The peculiar radiate tunic margin of the type form (Jacquin, *Icones Plantarum Rariorum* tab. 280) is uncommon but known in a few collections from the south western Cape (Barker 8049, Goldblatt 6283—Malmesbury; Duthie 619—Stellenbosch). In summer rainfall areas the characteristic features of the corm are weakly developed or not evident, the tunics are brittle-papery, rather than woody, and the corms usually small. The name *H. tysonii* has been given to the summer rainfall area form of *H. radiata*, but apart from the corm there seem to be no significant differences between this and many of the collections of *H. radiata* from the south western Cape. Plant and flower size are consistently large in summer rainfall area plants, but fall within the range of variation encountered in the south west and western Cape. Differences between plants from summer and winter rainfall areas thus seem negligible, and except for the softness of the corm tunics (encountered in some southern Cape forms, e.g. Glass 736—Grahamstown) it is often impossible to tell with certainty whether plants are the eastern or western form. The corm differences are probably related to soil and moisture conditions. I prefer not to consider them of taxonomic significance, at least at specific rank.

An unusual, small-flowered form with a rather congested spike has been given specific recognition as *H. tenuifolius* Salisb. and *H. caricina* (Ker) Klatt, both species based on *Hesperantha radiata* var. *caricina* Ker. This form, which is restricted to the south western Cape, has bracts in the 10–12 mm range, small flowers with tepals 7–9 mm and anthers ca. 4 mm long (e.g. Garside 1853—Stellenbosch flats; *H. Bolus* v.n.—Rosebank) and may represent a distinct race but I do not feel that taxonomic recognition is warranted. There is no discontinuity in the range of flower and bract size be-

tween this small-flowered form and the largest-flowered plants of the same general area.

A collection made by Zeyher, *Zeyher 3957*, consisting of several plants each with a single flowered spike, has caused some confusion. Both R. C. Foster and G. J. Lewis have considered this an undescribed species. Its corm and general appearance match *H. radiata*. Collections such as *Goldblatt 5179A* and *Goldblatt 5138* consist of a range of plants with from two to ten or more flowers and provide a link between the single-flowered specimens of *Zeyher 3957* and *H. radiata* proper, and suggest that the Zeyher collection merely represents a population of extremely depauperate plants.

Hesperantha angusta (Jacq.) Ker and its homotypic synonyms *Ixia angusta* and *I. linearis* have at times been treated as conspecific with *H. radiata* (e.g. Ker 1827: 90). This species, typified by a figure in Jacquin's *Icones Plantarum Rariorum* tab. 279 (the plate preceding that of the type of *H. radiata*) has a straight perianth tube, flexuose stem, and few-flowered inflorescence, does not appear to belong to section *Radiata* and is most probably a synonym of *H. falcata*.

SOUTH AFRICA, CAPE—2817 (Vioolsdrif): Kliphoogte, Richtersveld (-CD), *Herre s.n.* (BOL).

—2917 (Springbok): Steinkopf, Kasteelport (-BA), *Herre s.n.* (STE 11845); Top of Spektakel Pass, W of Springbok (-DA), *Goldblatt 5711* (MO, PRE, S, WAG); Hester Malan Reserve, Springbok (-DB), *Le Roux 831* (PRE); 6 miles E of Springbok, *Merxmüller & Giess* (M); Road to Wildeperdehoek, 23 km from Springbok (-DD), *Goldblatt 5751* (MO).

—3017 (Hondeklipbaai): Rietkloof, hills (-BD), *Schlechter 11202* (B, GRA, K, Z).

—3018 (Kamiesberg): Leliefontein (-AC), *Rodin 1470* (BOL, K, MO, PRE, UC); Pedros Kloof—Leliefontein, *Drège 2638* (B, G, K, MO); E slopes of Rooiberg on farm Welkom, *Goldblatt 5768* (M, MO, PRE); DeKom, Karas farm, Kamiesberg (-CA), *Leipoldt 3586* (BOL).

—3019 (Loeriesfontein): Kubiskouw (-CD), *Marloth 12876* (PRE).

—3118 (Van Rhynsdorp): Giftberg (-DC), *Phillips 7511* (BOL, K, SAM, STE); Nardouw Road, Clanwilliam (-DD), *Maguire 1032* (NBG), *Barker 3627* (NBG).

—3119 (Calvinia): Glenlyon, Nieuwoudtville (-AC), *Barker 9383* (NBG); Willemsrivier, *Leipoldt 806* (BOL, SAM); Nieuwoudtville distr., *L. Bolus s.n.* (BOL 21070, PRE), *Buhr s.n.* (NBG 60200); 2 miles N of Nieuwoudtville, *Nordenstam 741* (M, NBG, S); Van Rhyns Pass—Nieuwoudtville, *Lewis 2436* (SAM); Foot of the Hantamsberg (-BD), *Lewis 5813* (NBG); Flats near Augustfontein Mts., Calvinia distr. (-CD), *Lewis 5593* (NBG).

—3123 (Victoria West): Near Murraysburg (-DC-DD), *Tyson 305* (BOL, K, GRA).

—3124 (Middelberg): Gordonville, Sneeuberg (-DA/-DB), *Acocks 16529* (PRE).

—3218 (Clanwilliam): Sand flats near Velddrif (-AC), *Lewis 5988* (MO, NBG); Mamre hills (-AD), *Barker 1808* (NBG), *Compton 11780* (NBG); Groenekloof, *Zeyher s.n.* (SAM); 3 km W of Graafwater (-BA), *Goldblatt 3629* (MO, PRE); Blaauberg (-BD), *Schlechter 8449* (B, BOL, G, GRA, K, L, MO, P, PH, PRE, S, US, Z); Near Alpha, Algeria road, *Gillett 4134* (K); Greys Pass (-DB), *Mauve & Oliver 26* (STE); Zebra Kop, *Esterhuysen s.n.* (MO); Piketberg Mt. (-DC), *Martin*

367 (NBG); Piketberg, *Guthrie* 2703 (NBG); DeHoek-Sauer, *Van Niekerk* 600 (BOL); Berg River bridge, *Schlechter* 5270 (B, Z).

—3219 (Wuppertal): Eikerboom, Cedarberg (-AC), *Leighton s.n.* (SAM 52419); Middelberg plateau, *Esterhuysen* 7232 (BOL), 7276 (BOL, PRE); Between Ezelsbank and Dwarsrivier, 3–4000 feet, *Drège s.n.* (S); Middelberg, vlakke, *Goldblatt* 5138 (MO); Grootlands plateau, *Jackson s.n.* (NBG 60205); Citadel Kop, Cedarberg, *Compton* 24285 (NBG); Elandskloof (-CA), *Lewis s.n.* (BOL); Kromme R., Cedarberg, *Acocks* 2216 (S); Shale hill S of Citrusdal, *Goldblatt* 6266 (MO); Schoongesig, Cold Bokkeveld (-CC), *Hanekom* 1271 (K, PRE); Bokkeveld Tafelberg (-CD), *Esterhuysen* 3912 (BOL); North end of Cold Bokkeveld, *Goldblatt* 5343 (MO, PRE); Bokkeveld River farms, campsite, *Middlemost* 2248 (NBG).

—3220 (Sutherland): Fransplaas, Sutherland distr. (-B), *Marloth* 9832 (B, PRE); 40 miles NW of Sutherland (-AD), *Hall* 3295 (NBG); Voëlfontein, NW of Sutherland, valley S of farm house, *Goldblatt* 6315 (MO, NBG, S).

—3225 (Somerset East): Somerset East (-DA), *Bowker s.n.* (K).

—3226 (Fort Beaufort): Katberg, (-BC), *Galpin* 1724 (B, K, GRA, PRE); Above Foresters Cottage, Katberg, *Dyer* 1791 (GRA), *Hutchinson* 1679 (K); Alice (-DD), *Bokelman s.n.* (NBG 60065).

—3317 (Saldanha): Hoetjies Bay, dunes (-BB), *H. Bolus s.n.* (BOL 12840).

—3318 (Cape Town): Geelbek, Malmesbury Div. (-AA), *Barker* 4616 (NBG); Langebaan Peninsula, *Boucher* 2782 (STE); Near Hopefield (-AB), *Bachmann* 2171 (B); Platteklip, Darling (-AD), *Liebenberg* 8271 (PRE); Moorreesburg (-BA), *Bachmann* 1175 (B, Z); Hills around Malmesbury (-BC), *Schlechter* 1659 (B, GRA, L, PRE, Z); Malmesbury commonage, burnt ground, *Barker* 8049 (NBG), *Lewis* 3639 (SAM); Riverlands, *Esterhuysen s.n.* (MO); Table Mt., Diamond Spring Path (-CD), *Esterhuysen s.n.* (SAM 54323); Table Mt., *Ecklon* 400 (K, MO, S, PRE, Z), *Schinz s.n.* (Z), *Zeyher s.n.* (SAM 20813); Table Mt. between Skeleton and Window Gorges, *Esterhuysen* 11221 (BOL, PRE); Table Mt. near summit, *Wolley Dod* 2118 (K); Rosebank, Cape Town, *H. Bolus s.n.* (BOL 3769, K, PRE, Z); Signal Hill, *Wolley Dod* 3456 (K), *Wilms* 3706 (B, K), *Marloth* 1591 (PRE); Camps Bay, *Prior s.n.* (K, PRE, Z), *Cassidy s.n.* (NBG); Lions Mt., *Schlechter* 1371 (B, G, Z); Tygerberg Nature Reserve (-DC), *Loubser* 3028 (MO); Langverwacht, Kuils River, *Oliver* 4756 (K, PRE, STE), 4332 (K, STE); Stellenbosch (-DD), *Sanderson s.n.* (K), *Duthie* 619 (BOL); Stellenbosch flats, *Garside* 1653 (B, K), *Holzappel* 10 (STE); Flats N of Hercules Pillar, *Acocks* 4707 (S); Lower slopes of Bottellary hills, near Faure, *Stokoe s.n.* (SAM); Flats N of Bottellary road, *Acocks* 1913 (S).

—3319 (Worcester): Visgat (-AA), *Stokoe s.n.* (SAM 63134); Sneeuëgat, Groot Winterhoek Mts., *Phillips* 1873 (SAM); Op-de-Berg, Cold Bokkeveld, *Thompson* 1558 (STE); Tulbagh Road station (-AC), *Guthrie* 3014 (NBG); Tulbagh, *Burchell* 1037 (K); Michells Pass (-AD), *Barker* 4896 (NBG); Flats N of Prince Alfred Hamlet, *Oliver* 5048 (STE); Near Wolseley, *Diels* 1004 (B); Keeromsberg, shale band (-BA), *Esterhuysen* 9276 (BOL); Waaihoek (-BB), *Esterhuysen* 8296 (BOL); Sentinel Camp, Hex River Mts. (-CA), *Esterhuysen* 8439 (BOL); Darling Bridge, *Walgae* 400 (NBG); Worcester Veld Reserve (-CB), *Olivier* 122 (STE); Foot of Naudesberg, Koo (-DA), *Lewis* 5705 (MO, NBG, PRE, S, STE); Sand Hills, Worcester district, *Walters* 4 (NBG).

—3320 (Montagu): Tweedside (-AB), *Marloth* 10826 (PRE); Touws River, flats N of town (-AC), *Goldblatt* 70 (J), 146 (J); Bonnievale hills (-CC), *Marloth* 11822 (PRE, STE), 11823 (PRE).

—3321 (Ladismith): Towerkop kloof, Ladismith (-A), *Wurris* 1155 (NBG); Rooiberg, kloof W of Teeboskop (-DA), *Oliver* 5338 (STE).

—3322 (Oudtshoorn): Near George (-CD), *Burchell* 6086 (K); Doornkraal farm, De

Rust (-DA), *Dahlstrand* 2160 (STE), 2113 (J); Groot Umtini (Homtini) (-DD), *Schlechter* 5904 (B, BOL, GRA, L, PRE, Z).

—3323 (Willowmore): 2 miles east of Keurbooms River (-CD), *Gillett* 1402 (BOL); Blaauwbosch Pass (-DC), *Fourcade* 2817 (BOL, K, MO, PRE, STE).

—3324 (Steytlerville): Baviaans Kloof (-CA), *Bayliss* 7705 (MO, NBG); Bokkraal, 51.5 miles from Humansdorp, on road to Willowmore, *Fourcade* 5161 (BOL, STE); Poort between Patensie and Cambria (-DA), *Thompson* 1892 (STE); Cockscorn, Great Winterhoek Mts. (-DB), *Esterhuysen* 27504 (NBG, PRE); 5.5 km north of Hankey (-DD), *Goldblatt* 4932 (MO).

—3325 (Port Elizabeth): Bethelsdorp (-CD), *Long* 1356 (K, PRE); Redhouse (-DC), *H. Bolus* s.n. (BOL 195 in GRA), *Paterson* 47 (BOL); Along Swartkops R. and Addo, *Ecklon* 232 (MO, S, SAM); Perseverance, sand near river, *Bayliss* 4837 (MO).

—3326 (Grahamstown): Riebeeck East, Albany district (-AA), *Bayliss* 5937 (MO, Z); Howisons Poort (-AD), *Glass* 736 (NBG, SAM); Near Tunnel, Grahamstown, *Daly & Cherry* s.n. (GRA, J, PRE 25864); Grass slopes round Grahamstown (-BC), *Galpin* 283 (GRA, K, PRE); Grahamstown, *MacOwan* s.n. (K).

—3418 (Simonstown): Grootkop, C. Peninsula (-AB), *Compton* 19417 (NBG); Lower slopes of Klaasjagersberg, *Goldblatt* 5269 (MO); Krom R., C. Peninsula, *Barker* 3879 (NBG); Simons Bay, *Wright* s.n. (GH, K); Sir Lowry's Pass (-BB), *Schlechter* 1130 (B, BOL, Z); Hottentots Holland, *Zeyher* s.n. (SAM 20810); Palmiet River mouth (-BD), *Barker* 1480 (NBG); Porter Reserve, Betty's Bay, *Tijmens* s.n. (NBG 52899).

—3419 (Caledon): Victoria Peak (-AA), *Esterhuysen* 9764 (BOL); Foot of Houw Hoek Pass, *Goldblatt* 3685 (MO), 5638 (MO); Caledon Zwartberg and Baths (-AB), *Ecklon & Zeyher* *Irid.* 237 (G, MO); Highlands (-AC), *Compton* 12252 (NBG); Fernkloof Nature Reserve, Hermanus, *Goldblatt* 5179A (MO), *Robertson* 393 (MO); Die Mond, Voëlklip, Hermanus (-AD), *S. Williams* 333 (MO); Riviersonderend Mts. (-BB), *Stokoe* s.n. (SAM 57328).

—3420 (Bredasdorp): Between the Riviersonderend and Breede Rivers (-AA), *Ecklon & Zeyher* s.n. (P); am Riviersondereinde bei Stormvlei, Hessaquaskloof bis Breederivier, *Ecklon & Zeyher* *Irid.* 233 (89.9) (B, C, G, GH, LD, MO, UPS, US).

—3421 (Riversdale): Riversdale (-AB), *Rust* 626 (B), 5 (B); *Albertinia* commonage (-BA), *Muir* 969 (BOL); Road to Gouritz R. mouth (-BD), *Lewis* 5593 (NBG).

—3423 (Knysna): Knysna (-AA), *Newdegate* s.n. (B); Hills above Witte Drift, Knysna (-AB), *Fourcade* 1503 (BOL); Plettenberg Bay, *Smart* s.n. sub *Rogers* 27958 (Z).

Without precise locality: Silverrivier, *Penther* s.n. (Z); Blesbokvlakte 3–4000 feet, *Drege* s.n. (S); *Thunberg* s.n. (S, UPS); *Sparrman* s.n. (S, UPS); *Rogers* s.n. (K); *Harvey* s.n. (K); *Siebold* s.n. (B); *Link* s.n. (B); *Bergius* s.n. (B); *Mund & Maire* 502 (B); *Ecklon & Zeyher* s.n. (B); *Zeyher* 3907 (B, SAM), 3756 (P); *Verreaux* s.n. (G); *Roxburgh* s.n. (G); *Lalande* s.n. (P); In montibus pr. Broekhuizens Poort, *MacOwan* 1138 (S); Kareebergen, *Burchell* 1548 (K).

(Material seen from outside the map area (Fig. 30) is not cited.)

33. *Hesperantha marlothii* Foster, Contr. Gray Herb. 166: 20. 1948. Type: S. Africa, Sutherland distr., towards Waterkloof, *Marloth* 10412 (B, holotype; PRE, STE, isotypes). **Fig. 31.**

Plants (40–)60–200(–250) mm high. *Corm* symmetric, triangular in outline, flat based, 8–13 mm in diameter at widest, with spiny projections ex-

tending from the base, tunics dark, usually with several layers present, outer decreasing in size. *Cataphyll* solitary, membranous. *Leaves* 3(–4), basal, uppermost often sheathing stem for some distance, linear, longest about as long as stem, (1–)1.5–3 mm wide. *Stem* erect, simple, usually bearing a leaf-like bract inserted in lower half. *Spike* (1–)2–5-flowered; *bracts* herbaceous, often flushed with red, 10–20 mm, subequal or inner shorter, outer sheathing stem only at base or for 2–4 mm, but no more than one-third its length. *Flower* facing downwards, sweet-scented, opening at sunset, cream, outer tepals red-brown on reverse; *perianth tube* 10–12 mm long, curving at or near apex of bracts, usually shortly exserted; *tepals* 10–15 mm long, slightly reflexed when fully open, narrowly ovoid, 4–5 mm wide. *Filaments* 4–6 mm long; *anthers* 4–6 mm, pendent. Ovary 2–4 mm long, style branches 7–10 mm. *Capsule* ovoid-oblong, 6–8 mm long and 4 mm wide, initially enclosed by bracts. *Chromosome number* $2n = 26$. (Goldblatt 5813, 5835A).

Flowering time: late July–September.

Distribution: Roggeveld escarpment west of Sutherland and Middelpos, the Bokkeveld escarpment between Nieuwoudtville and Lokenburg, and local in the northern Cold Bokkeveld and the high country east of Matroosberg; typically in shallow soil overlying rock, usually waterlogged in winter and spring. Fig. 31.

Hesperantha marlothii is morphologically very similar to *H. radiata* and the two species have nearly identical flowers. *Hesperantha marlothii* differs in its depressed corm with a broad flat base from which long spines are produced; a rather few-flowered inflorescence; and bracts which are united only at their base (or for only a short distance) around the stem. The species was, until recently, poorly known but it has now been collected at several localities over a wide geographical range. It grows in seasonally moist situations, either in seeps, marshes, or stream banks, and often in shallow soil overlying rock. *Hesperantha radiata* occurs in the same general area as *H. marlothii*, usually on deeper soils and drier situations. It is clear that *H. marlothii* is not merely an ecological variant of the more widespread *H. radiata*, but the two species are obviously closely related.

Hesperantha marlothii is rather variable in size and number of flowers per spike. Robust plants are more common in the Roggeveld, in the south of its range, where soils are generally richer than along the Bokkeveld escarpment where the substrate is a nutrient poor, coarse quartzitic sand. Some populations from the Bokkeveld escarpment, e.g. Goldblatt 5835A from near Nieuwoudtville, growing on very thin soil, are single-flowered and so stunted as to appear at first specifically distinct. Plants from deeper soils in the area, e.g. Goldblatt 3960 and Lewis 5842 are larger, and 2–3 flowered, while some populations here collected in favourable growing

seasons comprise a range of plants (*Goldblatt 6219*), the largest of which are 3–4-flowered and as robust as, and indistinguishable from, plants collected in the Roggeveld. Given the degree of variability in populations throughout the range of the species, it does not seem worthwhile recognising the smaller northern form as taxonomically distinct.

SOUTH AFRICA, CAPE—3119 (Calvinia): Depressions in rocky pavement W of Nieuwoudtville (-AC), *Goldblatt 5835A* (MO); 3 miles W of Nieuwoudtville, *Lewis 1985* (BOL, SAM); Meulsteenvlei, near edge of escarpment, *Lewis 5869* (NBG); Near Grasberg, *Lewis 5842* (NBG); 8 km NW of Nieuwoudtville, on Grasberg road, *Goldblatt 3960* (K, MO, PRE, S); Oorlogskloof hills, *Schlechter 10946* (B, BOL, GRA, PRE); Lokenburg, arid fynbos (-CA), *Acocks 16864* (PRE); Roggeveld Mts, Vondelingsfontein, E of escarpment (-DD), *Thompson 2485* (PRE, STE).



FIG. 31.

Morphology and distribution of *Hesperantha marlothii*. Habits $\times 0.5$; flower and corm life-size (vouchers: flowering material *Goldblatt 6314*, Voëlfontein, Roggeveld; fruiting material *Goldblatt 5835A*, Nieuwoudtville).

—3120 (Williston): Blomfontein farm, W of Middelpas (-CC), *Barker 10773* (NBG); 66 km S of Calvinia on Blomfontein road, *Goldblatt 5813* (K, MO).

—3219 (Wuppertal): Cold Bokkeveld, 14,3 miles N of Excelsior farm (-CD), *Taylor 5922* (STE).

—3220 (Sutherland): Quaggasfontein farm, on road to Agterplaas, Roggeveld, 4700 ft (-AB), *Goldblatt 6351* (K, MO); Voëlfontein farm, Sutherland district (-AD), *Hall 3275* (NBG, S), *Hall s.n.* (NBG 87499); Voëlfontein, valley S of farm house, common in wet places, *Goldblatt 6314* (K, MO, NBG, PRE, S, US); Klipfontein, SW of Sutherland, *Thompson 1788* (K, PRE, STE), *Oliver 4397* (STE); Stony place, towards Waterkloof (-BC), *Marloth 10412* (B, PRE, STE); Geelhoek, 10 miles WSW of Sutherland, *Acocis 16993* (STE).

—3319 (Worcester): Between Rooihogte Pass and Matroosberg Station, near FM tower (-DB), *Mauve & Oliver 191* (STE).

34. *Hesperantha muirii* (L. Bolus) Lewis, JI S. Afr. Bot. 7: 32. 1941. Fig. 32.

Acidanthera muirii L. Bolus, Ann. Bolus Herb. 1: 195. 1915. Type: S. Africa, Cape, Tygersfontein-Skilpadgat, Riversdale distr., *Muir 1087* (BOL, holotype).

Hesperantha muirii var. *robusta* Lewis, JI S. Afr. Bot. 7: 33. 1941. Types: S. Africa, Cape, Plattekop farm, Riversdale, *Ferguson s.n.* (BOL 19966, lectotype here designated; K, isoelectotype); Near Riversdale, *Schlechter 1819* (PRE, syntype; GH, GRA, K, P, isosyntype).

Plants 100–200 mm high. *Corm* ± campanulate, 6–8 mm in diameter, base flat, or oblique, tunics brown, of several overlapping layers, divided below into regular segments each with a minutely fringed margin. *Cataphyll* solitary, membranous, brown. *Leaves* 2–4, basal, uppermost sheathing the stem for some distance, linear, erect, 30–80 mm long, 1.5–2 mm wide. *Stem* erect, simple, bearing (1–)2 sheathing bract-like leaves, lower with a free apex, and leafy, upper sometimes reaching to base of spike. *Spike* 1–3-flowered; *bracts* herbaceous, often red-flushed, 18–30(–40) mm long; outer with margins united at base round stem or inner bract, for 2–3 mm, inner equal to or smaller than outer. *Flower* secund, pale pink to ivory, zygomorphic with unilateral, ultimately dependent anthers; *perianth tube* 15–25 mm long, curved towards apex; *tepals* 15–25 mm long, 6–9 mm wide, narrowly ovoid-elliptic. *Filaments* 8–10 mm; *anthers* 6–10 mm long, evidently unilateral. Ovary ca. 5 mm long, style branches to 15 mm, exceeding anthers, loosely twisted and pendent. *Capsule* 15–20 mm long, narrow, enclosed in bracts. *Chromosome number* $2n = 26$ (*Goldblatt 5189*).

Flowering time: October–November.

Distribution: clay slopes and flats between Albertinia and the Bredasdorp district, especially common around Riversdale. Fig 32.



FIG. 32.

Morphology of *Hesperantha muirii* and distribution of *H. muirii* and *H. juncifolia*. Flowering spike and corms life-size (voucher Goldblatt 5189, Riversdale).

Hesperantha muirii is placed here in section *Radiata*, which contains most of the species of the genus with a curved perianth tube. It is one of the more distinctive species of the alliance, standing well apart from *H. radiata* and its relatives. It is striking in its large pale pink to ivory flower, long bracts and very small corms which resemble in form those found in *H. radiata*. A larger, several-flowered form, named var. *robusta* by Lewis (1941) does not in my opinion warrant taxonomic recognition. Variation in some populations is considerable near Riversdale (e.g. Goldblatt 5189), and may include a range of plants from dwarf, 1–2-flowered individuals in dry exposed situations, to taller, 2–3-flowered individuals, matching var. *robusta*, in more favoured places. This large-flowered species would appear to be a desirable horticultural subject.

SOUTH AFRICA, CAPE—3420 (Bredasdorp): Vrede, 40 km N of Bredasdorp on Swellendam road (-AC), Thompson 3271 (K, PRE); W base of Potberg (-BC), Pillans 9355 (BOL, NBG, PRE).

—3421 (Riversdale): Plattekop farm 3–4 miles from Riversdale (-AB), Ferguson s.n. (BOL 19966, K); Riversdale, Schlechter 1819 (GH, GRA, K, P, PRE); 5 km W of

Riversdale, *Goldblatt* 5189 (B, BOL, C, E, K, M, MO, NBG, P, PRE, US, WAG), *Goldblatt* 5437 (MO); Tygersfontein, beyond Schuldpadgat (-BA), *Muir* 1087 (BOL); Summit of hills beyond Skilpaddrift, near Albertinia, *Muir* 1836 (J, K).

Without precise locality: Riversdale Division, *Cape Town Wild Flower Show* s.n. (BOL 22554).

35. *Hesperantha juncifolia* Goldbl., sp. nov.

Plantae 180–200 mm altae, *cormo* ad 15 mm in diametro, \pm campanulato, tunicis imbricatis, foliis 4, inferioribus duobus basalibus, imbricatis, teretibus, ca. 1,5 mm in diametro, *spicis* ca. 8 floribus, *bracteis* (10–)12–14 mm longis, marginibus connatis infra, *floribus* hypocrateriformibus, albis, rubris dorso tepalis exterioribus, *tubo perianthii* 5–6 mm longo, *tepalis* 13–15 mm longis, *filamentis* brevibus, ad 2 mm longis, *antheris* ca. 6 mm longis.

Type: S. Africa, Cape, Bredasdorp distr., Ratel River, limestone flats, *Goldblatt* 403 (BOL, holotype).

Plants 180–200 mm high. *Corm* large, to 15 mm in diameter, more or less campanulate with an oblique flat base, tunics imbricate, with older layers accumulating above, scalloped below into segments, each somewhat concave with raised edges. *Cataphyll* single, dry, membranous. *Leaves* terete, narrow, ca. 1,5 mm in diameter, usually 4, lower 2 basal, upper inserted in stem, leaf sheaths overlapping one another, uppermost leaf sheathing stem to shortly below spike, with free distal part about as long as spike. *Stem* erect, simple, sheathed by leaf bases. *Spike* ca. 8-flowered, *bracts* (10–)12–14 mm long, green below, membranous above, margins of outer bract united in lower half to third, round stem, inner bract slightly shorter than outer. *Flower* secund, hypocrateriform, white, with red on reverse of outer tepals, subzygomorphic with anthers held towards upper tepal and style branches against lower tepals; *perianth tube* straight, 5–6 mm long, shorter than bracts; *tepals* obovate, acute, 13–15 mm long, outer to 6 mm wide, inner to 5 mm. *Filaments* to 2 mm long; *anthers* ca. 6 mm long. Ovary spindle-shaped, 4–5 mm long, style branches ca. 9 mm long, unilateral. *Cap-sule* unknown, *Chromosome number* unknown.

Flowering time: late September–October.

Distribution: from the single collection known, an endemic of limestone flats along the Cape Agulhas coast. Fig. 32.

The peculiar corm tunics with their scalloped concave segments and bracts united round the stem place *Hesperantha juncifolia* quite clearly in section *Radiata*. It is probably most closely allied to *H. radiata* from which it

differs in its long and terete, junciform leaves, and relatively short, straight perianth tube. The corm tunics are very like those found in some populations of *H. radiata*. *Hesperantha juncifolia*, apparently an endemic of the Agulhas coast, is probably confined to the limestone belt of this area. Further collections are needed to establish how rare the species is, but it is almost certainly endangered, given the massive encroachment of the southern Cape limestone flora by the aggressive alien tree *Acacia cyclops*, which chokes out the native vegetation as it spreads.

SOUTH AFRICA, CAPE—3419 (Caledon): Ratel River, limestone flats near Quoin Point (-DC), *Goldblatt 403* (BOL).

36. *Hesperantha elsiae* Goldbl., sp. nov. Fig. 33.

Plantae 250–300 mm altae, *cormo* 10–12 mm in diametro, \pm globoso, tunicis imbricatis, *foliis* 3–4, inferioribus duobus basalibus, ca. 1 mm latis, *spicis* 1–4 floribus, *bracteis* ca. 15 mm longis, submembranaceis, floribus carneis, *tubo perianthii* 13–21 mm longo, supra expanso, staminibus inclusis, *tepals* 13–15 mm longis, *filamentis* brevibus, ca. 1,5 mm longis in medio tubo insertis, *antheris* ca. 5,5 mm longis, inclusis, stylo breve, apicibus ramorum ex tubo emergentibus.

Type: S. Africa, Cape, Cedarberg, Krom Rivier Kloof at Disa pool. *Goldblatt 5331* (MO, holotype; K, NBG, PRE, S, US, WAG, isotypes).

Plants 250–300 mm high. *Corm* \pm globose, 10–12 mm in diameter, asymmetric with an oblique flat base; tunics imbricate, brown, of several overlapping layers, the outer smaller, lower margins regularly V-notched into segments, old leaf bases and stems sometimes accumulating in a neck above the corm. *Cataphyll* solitary, membranous, pale to dark brown. *Leaves* 3–4, lower 2 basal and often dry by flowering time, linear, soft and drooping, about half as long as stem, ca. 1 mm wide, upper leaves cauline and partly sheathing. *Stem* erect, bearing 2–3 leaves, the lower longest and inserted near base, and sheathing for over half its length, upper entirely sheathing. *Spike* 1–4-flowered, flexuose; *bracts* submembranous, drying in upper half and red-flushed, ca. 15 mm long, inner usually slightly longer than outer, margins of outer united around stem at base. *Flower* second, deep pink, tube slightly curved and tepals spreading; *perianth tube* 13–21 mm long, narrow in lower part, expanded above to include anthers, well exerted from bracts; *tepals* outspread 13–15 mm long, 5–7 mm wide, inner slightly smaller than outer. *Filaments* ca. 1,5 mm long, inserted in middle of perianth tube; *anthers* ca. 5,5 mm long, entirely included in perianth tube.

Ovary ca. 4 mm long, style dividing at base of anthers, branches ca. 8 mm long, apices emerging from perianth tube. Capsule ovoid, ca. 9 mm long. Chromosome number $2n = 26$ (Goldblatt 5331).

Flowering time: December.

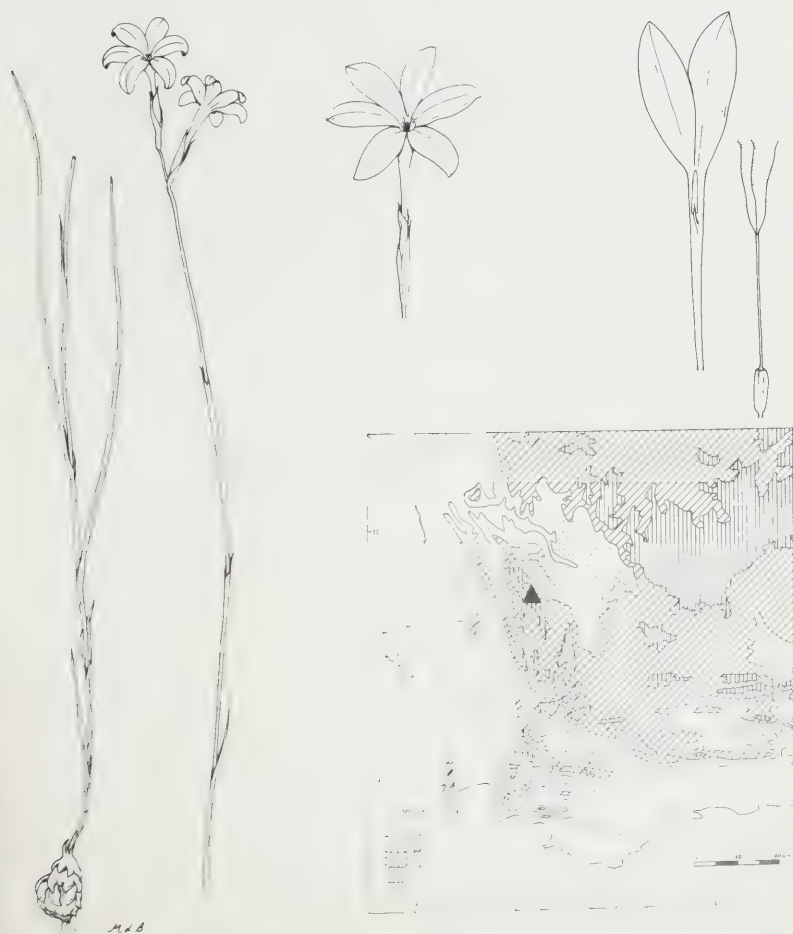


FIG. 33.

Morphology and distribution of *Hesperantha elsiae*. Habit $\times 0,5$; flower life-size; partial flower and gynoecium $\times 1,5$ (voucher Goldblatt 5331, Cedarberg above Krom River).

Distribution: southern Cedarberg, damp places at middle altitudes, ca. 1 200 m (ca. 4000 feet) on S-facing slopes. Fig. 33.

This very distinctive species was evidently first collected in 1950 by Elsie Esterhuysen, the well-known Cape botanist, and the species is named in her honour. There are apparently only two other collections, *Pattison s.n.* (BOL), said to have come from Hopefield, and the type collection, *Goldblatt 5331*, gathered in Krom Rivier Kloof where Esterhuysen first discovered it. *Hesperantha elsiae* is so distinct that there can be no question about the identity of the Pattison collection, but the locality is almost certainly incorrect, and the whole label may be misplaced.

Hesperantha elsiae is very striking in its general appearance, with narrow leaves, a long slender stem, and large pink flowers. The floral characters are even more unusual. The stamens are entirely included in the perianth tube, an unusual character in *Hesperantha*, shared only with the unrelated *H. cedarmontana*. The style divides within the tube, producing three long branches which extend between the anthers to emerge a short distance from the mouth of the tube. There seems no reason to doubt the generic position of the species even though the stamens and style are so unusual. The style, as in other species, does divide below the anthers, and the style branches are as long as in many other species, although largely included in the perianth tube.

Two other species of the genus have similar short filaments and included to partly included anthers and styles. These are *Hesperantha saldanhae* and *H. cedarmontana*, both of which belong to section *Hesperantha*, and have flat-sided corms. The former has exerted anthers on short 1 mm long filaments and is almost certainly related to *H. spicata*. *Hesperantha cedarmontana* has a style which divides within the tube, and the style branches may be entirely included or reach the apex of the tube, and is very different. Despite the shared similarities with these species, *H. elsiae* is most probably related to the widespread *H. radiata*, with which it is similar in general leaf and corm features, but differences are such that it stands in a fairly isolated position in section *Radiata*. It is clear that the unusual style and stamen characteristics were acquired independently in *H. elsiae*, *H. cedarmontana*, and *H. saldanhae*. The floral specialisation is presumably related to its insect pollinators, but nothing is yet known about pollination in this and most other species of *Hesperantha*.

SOUTH AFRICA, CAPE—3219 (Wuppertal): Krom River Kloof, ca. 4000 feet, *Esterhuysen 17966* (BOL, K, UPS), *Goldblatt 5331* (K, MO, NBG, PRE, S, US, WAG).

Doubtful locality: Hopefield, *Pattison s.n.* (BOL).

EXCLUDED SPECIES OF THE WINTER RAINFALL AREA

Hesperantha ciliata E. Meyer ex Klatt, Abh. nat. Ges. Halle **15**: 394 (Ergänz. 60) 1882, nom superf. pro *Geissorhiza rosea* Eckl. (Intended as a new species with *G. rosea* perhaps regarded as a nomen nudum). Type: South Africa, Cape, Hexrivierskloof, Drège 525 (B ex Herb. LU, holotype) = *Geissorhiza heterostyla* L. Bolus (syn. *G. rogersii* N.E.Br.)

Hesperantha crispa Eckl., Top. Verz. 22. 1827, nomen nudum. Identity unknown.

Hesperantha kermesina Klatt, Abh. nat. Ges. Halle **15**: 395 (Ergänz. 61) 1882. Type: South Africa, Cape, without precise locality, Drège 8480 (B ex Herb. LU, holotype) = *Geissorhiza inflexa* (de la Roche) Ker.

Hesperantha latifolia Spreng. ex Steudel, Nomencl. ed. 2, **1**: 753. 1840. "Herb. Ecklon", nomen nudum. Identity not known.

Hesperantha pentandra Drège ms., (in synonym. Baker, J. Linn. Soc. **16**: 163. 1878) = *IXIA scillaris* L. (Baker, 1896; Lewis, 1962).

Hesperantha quinquangularis Eckl., Top. Verz. **23**: 1827, nomen nudum [see also Klatt, Abh. nat. Ges. Halle **15**: 395 (Ergänz. 61) 1882] = *Geissorhiza inflexa* (de la Roche) Ker.

Hesperantha quinquangularis (Eckl. ex Klatt) Klatt, Durand & Schinz, Consp. Fl. Afr. **5**: 176. 1895, basionym *Geissorhiza quinquangularis* Eckl. ex Klatt, Linnaea **34**: 654. 1866. Types: South Africa, Cape, Caledon Zwartberg, Ecklon & Zeyher Irid. 214 [B, lectotype effectively designated by Foster (1941: 54)] = *Geissorhiza inflexa* (de la Roche) Ker (see Goldblatt & Barnard, 1970).

Hesperantha rosea Klatt, Abh. nat. Ges. Halle **15**: 395. (Ergänz. 61) 1882. Type: South Africa, Cape, Knysna, Newdegate s.n. (B ex Herb. LU, holotype) = *Geissorhiza heterostyla* L. Bol. (syn. *G. rogersii* N.E. Br.)

Hesperantha subulata Baker, Bull. Herb. Boiss. ser. 2, **1**: 864. 1901. Type: South Africa, Cape, Cape flats. Rehmann 1850 (Z, lectotype; BM, isolectotype) = *Geissorhiza juncea* (Link) A. Dietr.

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BOOK REVIEWS

FLORA ZAMBESIACA, volume VII part 1, edited by E. Launert, with pp. vi + 394, including 89 line drawings, 1 colour frontispiece. London: Flora Zambesiaca Managing Committee, 1983. Soft cover. £23.50. ISBN 0 95076 82 00.

The appearance of a part of the *Flora Zambesiaca* is almost as welcome, especially in the Transvaal, as a part of the *Flora of Southern Africa* because, at a rough estimate, about 80% of the genera and about half the species in that area are common to the northern and eastern parts of our territory. The present part maintains the high standard of printing, editing and presentation that we have come to expect from the *Flora Zambesiaca* and deals with 17 families, 61 genera and 310 species. The families now disposed of are the following, with the numbers in brackets indicating genera and species:

- Escalloniaceae, by B. Verdcourt (1: 1)
- Crassulaceae, by R. Fernandes (4: 51)
- Valerianaceae, by J. F. M. Cannon (1: 1)
- Dipsacaceae, by Margaret and J. F. M. Cannon (3: 7)
- Goodeniaceae, by E. Launert (1: 1)
- Campanulaceae, by M. Thulin (4: 27)
- Sphenocleaceae, by M. Thulin (1: 1)
- Lobeliaceae, by M. Thulin (3: 46)
- Ericaceae, by R. Ross (6: 21)
- Plumbaginaceae, by A. R. Vickery (1: 3)
- Primulaceae, by F. K. Kupicha (4: 16)
- Myrsinaceae, by F. K. Kupicha (4: 6)
- Sapotaceae, by F. K. Kupicha (12: 29)
- Ebenaceae, by F. White (2: 35)
- Oleaceae, by F. K. Kupicha (5: 23)
- Loganiaceae, by A. J. M. Leeuwenberg (6: 38)
- Salvadoraceae, by A. R. Vickery (3: 4)

The sequence is basically that of the Bentham & Hooker system, but certain exceptions have been made as a matter of convenience. As pointed out in the preface, the Escalloniaceae and Crassulaceae should have been included in vol. IV, but the Crassulaceae were omitted from that volume due to the death of Dr Raymond-Hamet, who had undertaken to do the family for the *Flora Zambesiaca*. Furthermore, the Valerianaceae and Dipsacaceae would normally have been placed at the beginning of vol. V (now in preparation), but were included in the present volume in order that vol. V may be devoted entirely to the Compositae.

The editorial board have been fortunate in obtaining the co-operation of many leading authorities in the preparation of the taxonomic treatments and this makes for stability in the presentation. In addition, the text is supported by excellent line drawings, at least one per genus and, in larger and more "difficult" genera such as *Crassula*, *Wahlenbergia*, *Lobelia*, *Diospyros*, *Euclea* and *Strychnos*, there are several to each genus. In *Diospyros* there are as many as twelve, which indicates the considerable care with which Frank White has presented the Ebenaceae.

Families 105 (Myrsinaceae) to 110 (Salvadoraceae) were dealt with in the first part of the *Flora of Southern Africa*, which appeared as vol. 26 in the series in 1963, so a comparison is inevitable. With few exceptions, the species concept remains much the same, but there have been some name changes, largely due to some re-thinking on generic limits in the Sapotaceae. These changes have been published elsewhere during the intervening years and have been picked up in recent books on our trees by Palmer & Pitman and by K. Coates Palgrave. In the Oleaceae, the inclusion of *Linociera* Swartz in *Chionanthus* L. by Stearn (1980) is more recent.

There are also certain changes of emphasis or status on which opinions may differ, but which will be carried by the weight of the authority presenting them. Thus *Olea africana* is placed as a subspecies of the closely related and probably derivative *O. europaea*, which may seem illogical to the non-taxonomist. Perhaps the most noticeable differences are in the treatment of *Euclea*, where previously designated varieties have been rescheduled as subspecies and several new subspecies have been described, reflecting the detailed ecological and cytological investigations undertaken by White and his co-workers.

The inherent difficulties experienced by various workers in classifying the Crasulaceae are reflected in the number of infraspecific taxa upheld in the genus *Crasula* and the extensive notes on variability of species in *Kalanchoe*. Perhaps a further synthesis in the former may be justified when more material or the results of studies in the field become available.

A point which calls for closer investigation is whether *Mimusops zeyheri* Sond. is really distinct from *M. obtusifolia* Lam. (= *M. kirkii* Bak.). Both are upheld and, according to the key, both occur in the Transvaal. In the *Flora of Southern Africa* a broad view of the species was taken and *M. kirkii* was included in *M. zeyheri*. *M. obtusifolia* is, of course, the oldest name for the complex. Some careful field work is required to clarify the position.

Literature references are adequate, being restricted to the more important taxonomic works and relevant regional studies. Typification is given in detail when the plant originated in the Flora Zambesiaca region, otherwise just the country of origin is indicated. In many of the latter cases, the details are known and it is felt they could be given without adding unduly to the length of the text. On the other hand, some of the descriptions seem unnecessarily long. A good index facilitates reference work. Two new species and five new names at subspecies level are published in this part.

At £23.50 the price is not high for a publication of this standard, but places it beyond the reach of the average postgraduate and many interested laymen. It will, however, be an important reference work for anyone studying the flora of Africa south of the Sahara.

L. E. CODD

PLANT INFECTION: THE PHYSIOLOGICAL AND BIOCHEMICAL BASIS, edited by Y. Asada, W. R. Bushnell, S. Ouchi and C. P. Vance, with pp. xviii + 362. Tokyo: Japan Scientific Societies Press [and] Berlin, Heidelberg, New York: Springer-Verlag, 1982. US \$50.40. ISBN 3-540-11873-X.

A preface by the editors and a short tribute by J. Kuć to Professors K. Tomiyama and I. Uritani, are followed by 22 short papers read during a U.S.-Japan seminar held in 1981 at Brainerd, Minnesota. The papers review accumulated knowledge and recent progress (some previously unpublished) in research on the physiological and

biochemical basis of infection. Each paper is followed by a comprehensive list of literature references and a summary of oral discussion. There is a short subject index at the end of the book, but no general author index.

In the first text paper, Y. Asada outlines the substantial contributions made by workers in Japan to our knowledge of the physiology and biochemistry of plant infection. R. D. Durbin then briefly discusses disease determinants and symptom expression, and suggests that a logical step-by-step analysis of the relationship of disease determinants to symptom expression will help us to explain plant diseases on a chemical basis. R. T. Sherwood and C. P. Vance review events occurring in epidermal cells during penetration by *Erysiphe graminis* and *Helminthosporium avenae*, with special attention to wall appositions and papilla formation. H. Kunoh summarises work on relations between primary germ tubes and the host plant during early stages of germination of *Erysiphe graminis* conidia.

In one of only two papers devoted solely to bacterial infection W. D. Bauer discusses the infection of soybean roots by *Rhizobium japonicum*, with particular attention to the initiation of infection (including the role of lectins) and host specificity.

There are three papers on hypersensitivity. N. Doke *et al.* describe aspects of elicitation and suppression of the hypersensitive response of host cells in the potato-*Phytophthora infestans* system. W. R. Bushnell reviews recent work on patterns of hypersensitivity to rusts and powdery mildews, and suggests that compatible fungi produce suppressors which limit the reaction. In his contribution (somewhat misplaced near the end of the book), K. Tomiyama describes hypersensitive cell death as a "key phenomenon in disease resistance" and as a "suicide response which saves the rest of the tissue from destruction". S. Ouchi and H. Oku enlarge on the concept that disease resistance is the rule in nature and that, in order to establish parasitic ("pseudosymbiotic") relationships with the host cells, pathogens must produce impediments ("impedins") to the host defence reactions. J. Kuć compares host resistance mechanisms with those provided by systemic fungicides, and develops a case for greater recognition of the potential for disease control by plant immunisation. K. Ōba *et al.* describe metabolic alterations in response to wounding and infection, with special reference to phytoalexin production in sweet potato roots. T. Kosuge and L. Comai discuss the role of indoleacetic acid in the *Pseudomonas savastanoi*-oleander/olive interaction and develop concepts involving secondary metabolites in the plant-pathogen interaction. R. J. Kemble and D. R. Pring review studies on mitochondrial DNA associated with cytoplasmic male sterility and *Helminthosporium maydis* susceptibility in maize carrying Texas cytoplasm.

Host specific toxins are dealt with in four papers. S. Nishimura *et al.* discuss the involvement of host-specific toxins in the pathology and epidemiology of diseases of different hosts caused by *Alternaria alternata* pathovars. J. M. Daly discusses the chemistry of host-specific *Helminthosporium* toxins and suggests that further work should enable us to resolve their modes of action on a molecular basis. T. Ueno *et al.* discuss the chemistry of host-specific *Alternaria* toxins, with K. Kohmoto *et al.* presenting evidence that the host chloroplast and the interface between cell wall and plasma membrane are two primary action sites for the AM toxin of the apple pathotype of *A. alternata*.

Needless to say, phytoalexins also receive considerable attention. In addition to the paper by K. Ōba *et al.*, M. Yoshikawa and H. Masago discuss biochemical aspects of the phytoalexin glyceollin and its elicitation in soybean by *Phytophthora megasperma* f. sp. *glycinea*. N. T. Keen then describes a direct phytoalexin elicitor-receptor model in gene-for-gene systems. In their discussion on phytoalexins and preformed antifungal compounds in relation to resistance of oat leaves to fungal attack, T. Tani and S. Mayama emphasise that there are "multiple mechanisms involved in induced resistance" and suggest that "plants respond to challenging micro-

organisms in quite different manners depending on the specific properties of the invading microorganisms". The series of papers on phytoalexins ends with a final exciting contribution by H. D. Vanetten on phytoalexin detoxification by fungal monooxygenases. In the final chapter of the book I. Uritani emphasises the contribution which studies of host-plant interactions have made to our understanding of the biochemistry and physiology of the normal plant.

The non-specialist often finds papers on the physiology of parasitism difficult to read. Both specialist and non-specialist will find this text interesting and readable. The graduate student will find the short overviews useful for their subject content, and he will be stimulated by the differences in emphasis and interpretation given to the different research results. In the South African context, the book will be read by the university teacher and by the research worker on host-parasite interactions. Individual chapters will undoubtedly be prescribed for both graduate and undergraduate students in plant pathology and plant physiology.

P. S. KNOX-DAVIES

FERTILIZATION OF DRYLAND AND IRRIGATED SOILS, by J. Habin and B. Tucker, with pp. vii + 188 and 64 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1982. Volume 12 in "Advanced Series in Agricultural Sciences". DM98, approximately US \$39.20. ISBN 3 540 11121 2.

This small, 188-page and well-produced book is clearly aimed at the advanced agricultural student. And as so much of South Africa is either dryland or irrigated, the subjects it discusses are of great topical interest. However, it is also of very considerable interest to botanists, nutritionalists, ecologists or pathologists, for whom a knowledge of soils and farming practice is very desirable, if not imperative.

This publication has a number of very unusual, but very useful, features. Each of its seven chapters has two footnotes. The first of these is entitled *Purpose* and briefly states what the authors intend to discuss. This is followed by another footnote with advice to the student, enumerating facts that he should learn. At the end of the chapter, there is always a list of questions preceding the references. These features make it an excellent book from which to study, and are even a help when using it for general reference purposes.

The book starts by defining its terms and then giving an adequate account of soil characteristics—no more is needed for this work. The same is true for crop production systems and irrigation. The reader is introduced to these topics as far as is necessary for the general comprehension of the fertilizer story.

The fertilizer story is very well told and most plant physiologists will read this book with interest, although it is unlike nutritional texts in many respects. The section on Nitrogen, over 20 % of the book, deals with the manufacture, uses and abuses of a large variety of nitrogenous fertilizers, the fate of the fertilizers in the soil by leaching and volatilization. The requirements of over ten crops are discussed.

This book is well documented. However, no authority is cited for the point made on p. 33 "Nitrates appear to be the preferred form of nitrogen by most plants, even though ammonium ions are also utilized by plants, *especially in the early growth stages*". This is probably true, but I have never seen it stated before.

The phosphorus and potassium chapters are equally informative but there is not the space to discuss them here, save to say that there is a lot of solid informative work available for the reader to digest. This is true of the secondary and micro-

nutrients as well. In all cases, details of fertilizers deficiencies, treatments and special crops are supplied. The section on iron is one that will be of very wide biological interest. The availability of this element in both plants and animals causes much concern. The authors draw attention to the chlorosis tolerant plants which can regulate the pH of their root exudates and appear to benefit from citrates to chelate the iron. Ecologists will appreciate the influence that litter plays in making iron available to plants.

This is a really excellent book and the authors are to be congratulated on its appearance. There are some good simple illustrations, but the photographs of granules of fertilizers or a tractor and ammonia cylinder do little to improve the text and are unnecessary. No serious misprints were observable and the only comment I would like to add is that the statement about molybdenum deficiencies not occurring in semi-arid regions (p. 136) does not apply to the Cape.

This excellent book should be on the reference shelf of every concerned botanist, especially the younger field workers. It is very informative and very readable. However, its price will be too high for those who would benefit most from its possession. What about a cheaper edition?

K. H. SCHÜTTE



SESSILISTIGMA, A NEW MONOTYPIC GENUS OF IRIDACEAE–IRIDOIDEAE FROM THE SOUTH WESTERN CAPE

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ABSTRACT

Sessilistigma radians is a new and evidently rare species, the only member of a new genus *Sessilistigma*. It is allied to the southern African genus *Homeria*, and is similar to several species especially of section *Homeria* in its single glaucous leaf, inserted well above the ground and flexuose branching pattern. *Sessilistigma* is distinctive in flower structure, having free stamens and a short vestigial style which divides just above the ovary into three broad, flat, diverging stigmatic arms, each deeply divided. In *Homeria* the filaments are united and the long, slender style is enclosed in the filament column. Basic chromosome number is $n = 6$, and the karyotype, as in *Homeria*, consists of large, acrocentric chromosomes. *Sessilistigma radians* has been successfully crossed with several species of *Homeria*, confirming the evident affinity with this genus suggested by the vegetative morphology.

TITREKSEL

**SESSILISTIGMA, 'N NUWE MONOTIPIESE GENUS VAN DIE IRIDACEAE –
IRIDOIDEAE VANAF DIE SUID-WESTELIKE KAAP**

Sessilistigma radians, 'n nuwe en blykbaar skaars species, is die enigste lid van 'n nuwe genus *Sessilistigma*. Dit is verwant aan die Suider-Afrikaanse genus *Homeria* en stem ooreen met verskeie species veral in die seksie *Homeria* wat sy enkele see-groen blaar, goed bokant die grond ingeplaas, en die golwende vertakkingspatroon betref. *Sessilistigma* word onderskei deur sy blombou met vry meeldrade en 'n kort vestigiale styl wat net bokant die ovarium in drie breë plat uiteenlopende diep-verdeelde stigma-arms vertak. In *Homeria* is die helmdrade vergroei en die lang dun styl ingesluit in die helmdraadkolom. Die basiese chromosoomgetal is $n = 6$ en die karyotipe, soos in *Homeria*, bestaan uit groot akrosentriese chromosome. *Sessilistigma radians* is suksesvol gekruis met verskeie *Homeria*-species wat die affiniteit, deur vegetatiewe morfologie voorgestel, bevestig.

Key words: *Sessilistigma*, gen. nov., Iridaceae–Iridoideae, south western Cape, chromosome cytology.

INTRODUCTION

Two collections, *Leipoldt 3553* and *Barker 1322*, of an unknown species of Iridaceae, clearly belonging to subfamily Iridoideae subtribe Homeriinae

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FIG. 1
Flowers of *Sessilistigma radians* Goldbl.

(Goldblatt, 1976) came to my attention during my recent studies of the southern African genus *Homeria* (Goldblatt, 1980; 1981). The blackish, reticulate corm tunics, a single, bifacial and channelled leaf inserted above the ground, and flexuose branching pattern correspond closely with several species of *Homeria* particularly those of section *Homeria*. However, the species has a flower with a number of unusual features which made it impossible to refer it to this genus. These floral characteristics include: entirely free stamens; a short, vestigial style; and unusual, deeply forked style arms which extend outwards on either side of the subtending filaments. These features prompted a more extensive study of the relationships of the species in order to determine its phylogenetic position and the true nature of the apparently simple and unspecialised flower combined with a highly derived vegetative morphology.

Both the Leipoldt and Barker collections had vague locality data indicating that the species grew somewhere in the area of Ashton and MacGregor, in the dry, broken plain lying between the Riviersonderend and the Langeberg Mountains east of Worcester, known as the Robertson Karoo. Only after repeated searches in this area of the south western Cape, did I succeed in locating one small population. Plants were discovered growing in semi-

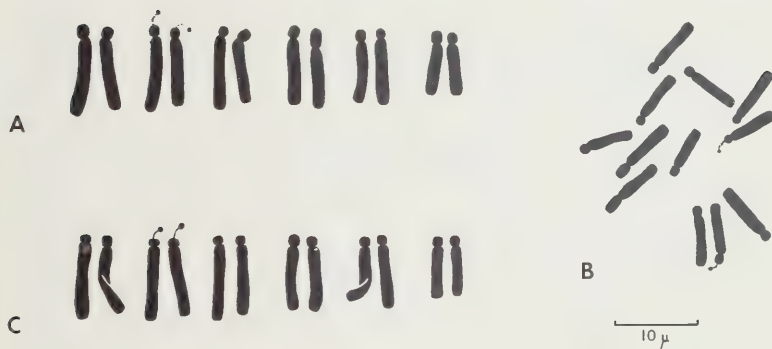


FIG. 2

Mitotic metaphase in *Sessilistigma* and, for comparison, a representative diploid species of *Homeria*: A-B. *Sessilistigma*; C. *H. miniata* (Andr.) Sweet (count reported by Goldblatt, 1980: Fig. 1 A).

karroid scrub at the foot of the Riversonderend Mountains, a short distance east of MacGregor. They corresponded in every detail with the previously collected specimens and with the excellent illustration provided by Barker with her collection.

CYTOLOGY AND HYBRID STUDIES

Chromosome cytology and crossing experiments are especially useful in Iridaceae in determining relationships of taxa (Goldblatt, 1976; 1980) and plants were therefore grown and flowered in the greenhouse.

Chromosome number was determined from mitotic metaphase in root tips, harvested and treated as described in detail elsewhere (Goldblatt, 1979; 1980). Root tip squashes revealed a diploid number of $2n = 12$. The karyotype (Fig. 2 A-B) consists of acrocentric chromosome pairs ranging in size from $6\ \mu$ – $8\ \mu$ long. This matches very closely the karyotypes of species of both *Homeria* (Goldblatt, 1980) and *Hexaglottis* (Goldblatt, 1971 and unpublished) that have the same chromosome number. The karyotype of one species of *Homeria* is illustrated here for comparison (Fig. 2 C).

A series of crossing experiments were undertaken when plants came into bloom. Reciprocal crosses were made with a range of species of *Homeria* and with *Hexaglottis namaquana* Goldbl. ined., the most generalised species of *Hexaglottis*. Results are detailed in Table 1 but can be summarised as follows. All attempts to cross *Sessilistigma* with *Hexaglottis namaquana* failed,

TABLE 1

Results of a crossing program between *Sessilistigma*, *Homeria* and *Hexaglottis* (crosses with *Sessilistigma* as male parent rarely succeeded, perhaps because of the longer styles of *Homeria* sp as compared with *Sessilistigma*).

Species	Attempts	Successes	Comments
<i>Sessilistigma</i> ×:			
<i>Homeria</i> section <i>Namaquana</i>			
<i>H. bolusii</i>	2	0	
<i>H. schlechteri</i>	2	0	
— section <i>Stipanthera</i>			
<i>H. cookii</i>	5	0	
— section <i>Conanthera</i>			
<i>H. fuscomontana</i>	2	1	few seeds produced
<i>H. spiralis</i>	7	7	
— section <i>Homeria</i>			
<i>H. bulbillifera</i>	3	0	
<i>H. flaccida</i>	12	4	undersized capsules, no viable seed very few seed
<i>H. ochroleuca</i>	2	2	
<i>H. pallescens</i>	2	2	
<i>H. patens</i>	5	0	
<i>Hexaglottis namaquana</i> . . .	6	0	

while it was possible to cross the genus with several species of *Homeria*, belonging to sections *Homeria* and *Conanthera*. Almost all crosses using *Sessilistigma* as the pollen parent failed, possibly due to the appreciable longer distance that the pollen has to travel down the stigmas of *Homeria* as compared with those of *Sessilistigma*. With *Homeria* as the pollen parent, successful crosses were obtained especially in section *Conanthera*, where the two species used in the study, *H. fuscomontana* Goldbl. and *H. spiralis* L. Bolus, proved interfertile, *H. spiralis* particularly so (Table 1). Fertility was much lower in crosses between the species of *Homeria* section *Homeria* but succeeded in both directions with *H. pallescens* of this section. Too few crosses were attempted with the remaining sections, *Namaquana* and *Stipanthera* for any valid conclusions to be drawn about their potential intercrossability with *Sessilistigma*. However, the main reason for the crossing studies was only to determine whether the generic relationships of *Sessilistigma* could be assessed at all by such methods, and in this the results are clearly successful.

The conclusion from these experiments is that *Sessilistigma* is closely allied to the vegetatively similar *Homeria* and not to *Hexaglottis*, despite their superficial floral similarities.

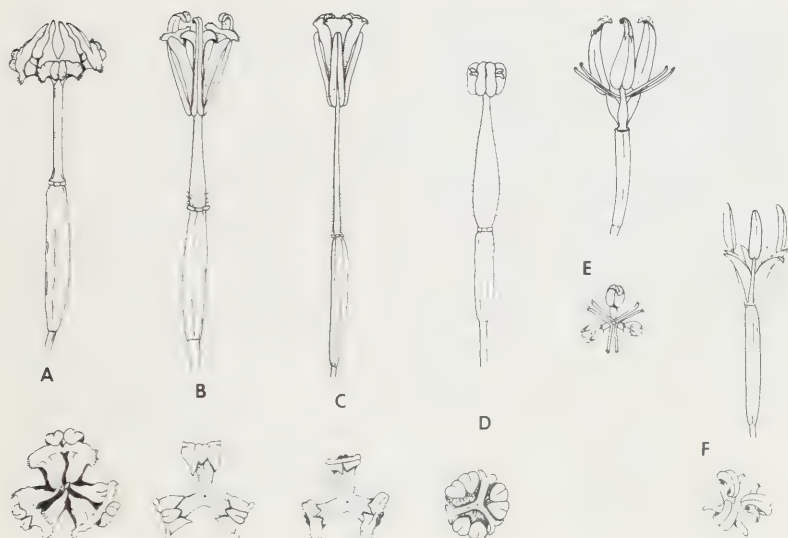


FIG. 3

The gynoecium and androecium in *Sessilistigma* and representative species of *Hexaglottis* and *Homeria*. A. *H. schlechteri*; B. *H. elegans*; C. *H. patens*; D. *H. bifida*; E. *Hexaglottis namaquensis*; F. *S. radians* (side views approx. $\times 2$; top views much enlarged).

MORPHOLOGY OF *HEXAGLOTTIS* AND *HOMERIA*

The floral characteristics of *Sessilistigma* are somewhat reminiscent of *Hexaglottis* (also subtribe *Homeriinae*). However, they differ in several details. The style branches of *Sessilistigma* are compressed, and short and broad, while those of *Hexaglottis* are long and filiform and extend outwards almost horizontally (Fig. 3 E, F). In addition, the style branches of *Hexaglottis* are not sessile, but diverge at the apex of a short but distinct style. The flowers of *Sessilistigma* last 2–3 days and those of *Hexaglottis* are fugitive and typically last only a few hours of the afternoon or evening. The vegetative morphology of *Sessilistigma* and *Hexaglottis* also corresponds poorly. The single, glaucous foliage leaf, inserted above the ground, and the flexuose stem with a few stalked branches of *Sessilistigma* are not matched in *Hexaglottis*. Well-grown individuals of *Hexaglottis* typically have two or more foliage leaves, only rarely inserted above the ground and the stems are straight, rather than flexed, and except in one species, *H. namaqualana*, the

lateral branches are sessile. This lack of correspondence in floral, as well as in vegetative morphology, together with the data from the hybrid studies, suggests strongly that *Sessilistigma* is not directly related to *Hexaglottis* and this possibility has been disregarded.

The vegetative morphology of *Sessilistigma* and *Homeria* correspond well, and it is impossible to distinguish most of the single-leaved species of *Homeria* from *Sessilistigma* in the non-flowering state. However, their floral structure is sharply different (Figs 3, 4). In *Homeria*, the filaments are united entirely or almost so, into a column in which the long slender style is enclosed. The style divides at or near the anther base into three branches which lie closely appressed to the anthers. The style branches may be as long as 8 mm or as short as 1 mm and vary considerably in structure. In sections *Namaquana*, *Stipanthera* and *Homeria*, the style branches are distinctly compressed, about as wide as the anthers and bear subterminal transverse stigmatic lobes, above which there are often short paired erect flaps of tissue known as crests (Fig. 3 A–C). In section *Conanthera* (Fig. 3 D) the anthers are contiguous and partly conceal the short, apically bifid style branches, the ends of which extend between the opposed anthers. The contrast in the structure of *S. radians*, with its virtually sessile style branches and free stamens is marked (Fig. 3 F).

ORIGIN OF *SESSILISTIGMA*

The interpretation that seems best to explain the unusual flower of *Sessilistigma*, in the light of its apparent relationship to *Homeria*, is that what seem to be unspecialised and free stamens are secondary and the ancestral form had united filaments as in *Homeria*. Also, the sessile style branches are so unusual in Iridaceae, that there can be no doubt that the absence of a well-developed style is a specialised feature. The style branches themselves are not much different from those found in species of *Homeria* in which the crests are poorly, or not at all developed (species of section *Conanthera*). Thus it seems reasonable to postulate that *Sessilistigma* arose from section *Conanthera* or from a line leading to this alliance. The limited data from the hybridisation experiments is consistent with this hypothesis, since *Sessilistigma* showed the greatest ability to cross with species of this section.

The question must be raised as to whether *Sessilistigma* should be included in *Homeria* in view of their similarity in vegetative morphology and limited interfertility. This seems to me undesirable. Its inclusion would extend the definition of *Homeria* beyond the normal limits of morphological variability in Iridaceae. It would also reduce the significance of what I believe is a major developmental change in the family. The unusual floral morphology of *Sessilistigma* is most likely based on relatively few genetic muta-

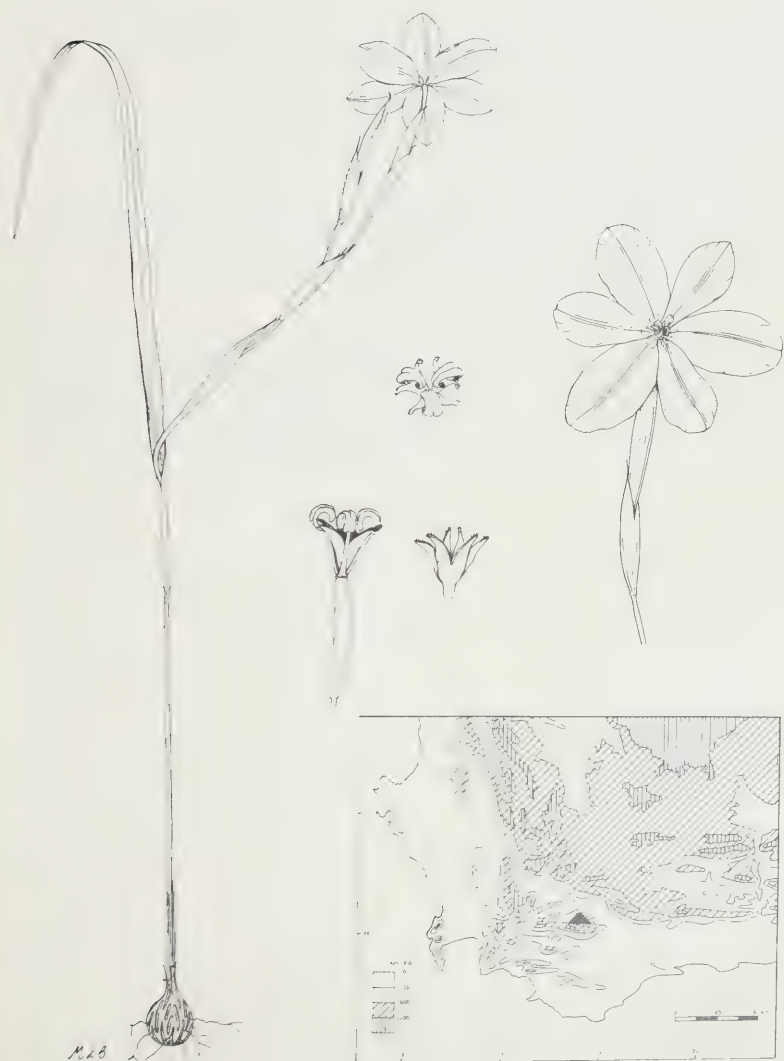


FIG. 4

Morphology and distribution of *Sessilistigma radians*. Whole plant $\times 0.5$, flower $\times 1$, androecium and gynoecium, side and top view $\times 2$, isolated style branches $\times 2$.

tions. These have nevertheless resulted in a profound structural reorganization of the flower. It seems appropriate that this be reflected in the systematics at generic level.

SYSTEMATICS

Sessilistigma Goldbl., gen. nov.

Plantae unifoliateae, caule ramoso, floribus tepalis liberis, unguibus brevibus, *filamentis* liberis, *stylo* vestigiali, ramis stylis bifurcatis filamentos oppo-

Type species: Sessilistigma radians Goldbl.

Plants with an apically rooting, single internode corm with blackish, coarsely reticulate tunics; *leaf* bifacial, solitary, channelled, inserted well above the ground; *inflorescence* enclosed in opposed, bract-like spathes; *flower* with free, shortly unguiculate tepals; *filaments* free, opposed to the broad, deeply forked style arms; *style* very short, vestigial.

Sessilistigma radians Goldbl., sp. nov. **Figs 1 and 4.**

Type: South Africa, Cape, between MacGregor and Stormsvlei at Steenbokvlakte turnoff, *Goldblatt* 5903 (MO, holotype; K, PRE, S, isotypes).

Plants (90-)150–350 mm high. *Corm* globose, 90–150 mm in diameter, tunics black, coarsely reticulate. *Cataphyll* dry, membranous, reaching shortly above ground. *Leaf* solitary, bifacial, channelled, erect below, spreading above, longer than stem, 2 to 5 mm wide, inserted on stem (25-)40–80 mm above the ground. *Stem* erect, flexed above sheathing base of leaf, usually at least 2–3-branched, stem bracts green, 20–35 mm long, entirely sheathing, attenuate, apices brown, branches flexed above sheathing base of bract. *Inflorescence* few to several-flowered, terminal, enclosed in large opposed sheathing, bract-like spathes; *inner spathe* 30–50 mm long, herbaceous, attenuate, apex dry and pale, outer similar but about half as long. *Flower* actinomorphic, buff with tepals bright yellow near base; *tepals* free, unguiculate, with short ascending claws 3–4 mm long, cupped around the base of the filaments and style arms, limbs held more or less horizontally on first opening, slightly reflexed on the second day, *outer* to 30 mm long, obovate, to 17 mm wide, with a conspicuous basal nectary, *inner* to 27 mm long, spatulate, ca. 15 mm wide, with a small basal nectary. *Filaments* free, ca. 4 mm long, opposite outer tepals, appressed to style arms, minutely papillate; *anthers* initially straight and 5 mm long, curving inward and downward after anthesis. *Ovary* to 10 mm long, exserted or included in spathes below; *style* short, ca. 1 mm long, dividing into three broad, yellow ascend-

ing branches ca.2 mm wide, style branches ca.3 mm long, deeply divided with diverging arms, stigmatic at the tips only. Capsule 12–15 mm long, oblong, truncate at apex. Chromosome number $2n = 12$ (Goldblatt 5903).

Flowering time: September–early October.

Distribution: local in the south western Cape, in semi-karroid vegetation at the northern foot of the Riviersonderend Mountains.

SOUTH AFRICA, CAPE—3319 (Worcester): Between MacGregor and Stormsvlei Kloof (-DD), *Leipoldt* 3553 (BOL); Turnoff to Steenboksvlakte, between MacGregor and Stormsvlei Kloof, *Goldblatt* 5903 (K, MO, PRE, S). —3320 (Montagu): Near Ashton (-CC), *Barker* 1322 (BOL, NBG, PRE).

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TEMPERATURE, TIMING OF PRECIPITATION AND SOIL TEXTURE EFFECTS ON GERMINATION, EMERGENCE AND SEEDLING SURVIVAL OF SOUTH AFRICAN LOVEGRASSES

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ABSTRACT

The germination, emergence and seedling survival of three South African lovegrasses and a genetically selected accession from parents originally collected in South Africa were evaluated at different temperatures, under different initial precipitation regimes and in three soils common to the south western U.S.A. Boer lovegrass (*Eragrostis curvula* var. *conferta* Nees) accession Catalina was genetically selected from boer lovegrass accession A-84; which was collected in South Africa. Catalina seed germinated over a wider range of temperatures, from greater depths in the three tested soils and seedlings were more drought tolerant than were those of Lehmann (*Eragrostis lehmanniana* Nees), Atherstone (*Eragrostis atherstonei* Stapf.) or boer lovegrass A-84.

UITTREKSEL

DIE INVLOED VAN TEMPERATUUR, FREKWENSIE VAN WATERTOEDIENING EN GRONDTEKSTUUR OP DIE ONTKIEMING, VERSKYNING EN SAAILINGGOORLEWING VAN SUID-AFRIKAANSE OULANDSGRASSE

Die ontkieming, verskyning en saailingoorlewing van drie Suid-Afrikaanse oulandsgrasse en 'n geneties geselekteerde aanwins van ouers wat oorspronklik in Suid-Afrika versamel is, is onder verskeie temperature, neerslag en drie grondsoorte wat algemeen in die suid-westelike V.S.A. voorkom, ge-evalueer. Boer-oulandsgras (*Eragrostis curvula* var. *conferta* Nees) aanwins Catalina is geneties geselekteer van boer-oulandsgras aanwins A-84, wat in Suid-Afrika versamel is. Catalina-saad het oor 'n wyer verskeidenheid temperature, vanuit die groter diepte in drie getoetste grondsoorte ontkiem en saailinge was meer droogtebestand as dié van Lehmann (*Eragrostis lehmanniana* Nees), Atherstone (*Eragrostis atherstonei* Stapf.) of Boer-oulandsgrasse A-84.

Key words: *Eragrostis*, lovegrass, south western U.S.A., germination, seedling survival, drought tolerance.

INTRODUCTION

More than 250 accessions of 80 grass species have been seeded at 400 non-irrigated locations in the south western U.S.A. and northern Mexico in the

past 92 years (Cox *et al.*, 1982). The most easily established and persistent grasses were either lovegrasses introduced from South Africa or genetic lines selected from South African grasses.

Lehmann lovegrass (*Eragrostis lehmanniana* Nees) accession 68 (A-68) and boer lovegrass (*Eragrostis curvula* var. *conferta* Nees) accession 84 (A-84) were introduced into the U.S.A. in mid-1930 (Cox *et al.*, 1982). Atherstone lovegrass (*Eragrostis atherstonei* Stapf.) accession 16753 was introduced in 1961 (Holzworth, 1980). Atherstone has been taxonomically re-identified as a hybrid cross between *Eragrostis lehmanniana* Nees and *Eragrostis trichophera* Coss & Dur. (Terrell, 1977) and renamed as Cochise lovegrass (Holzworth, 1980). Cochise lovegrass is generally easier to establish, more productive and persists longer than A-68 Lehmann lovegrass (Jordan, 1981).

Wright (1971) tested 16 boer lovegrass accessions for seedling drought tolerance under controlled environmental conditions. Only 216 of 50,000 seedlings survived. Seed was harvested from the interpollinating surviving plants in isolation and seedling drought tolerance was retested. Line 3-17 was superior in seedling drought tolerance and was named as Catalina boer lovegrass. Catalina traces to PI-203347 and A-84 boer lovegrass. Catalina was field tested in the semi-arid south western U.S.A. (Herbel *et al.*, 1973) and released in 1969 (Wright, 1971). Catalina seedlings in the field appear to be more drought tolerant than A-84 seedlings (Wright and Jordan, 1970) but mature plants are smaller and produce less forage than A-84 (Cox and Jordan, 1983).

Grass establishment from seed requires a viable seed and favourable temperature, precipitation and soil for germination and seedling development. Seeds often germinate but seedlings fail to survive because (1) temperatures are not within the tolerable range, (2) precipitation distribution and amounts are inadequate and (3) the root may not be capable of penetrating the soil.

Soil temperature and available soil water are often maximised in summer, and reseedling is conducted prior to warm season precipitation in non-irrigated arid and semi-arid regions of the world (Cox *et al.*, 1982; Silcock and Williams, 1976; Field-Dogdson, 1976). Soil water used in seed germination, emergence and seedling growth is replenished by precipitation and depleted by evapo-transpiration. Precipitation events in summer are intermittent, with rainfall periods being much shorter than dry periods. Therefore, soils near the surface, where seed are planted, often dry so rapidly after seed germination that the seedlings die. The identification of species or accessions which will germinate at temperatures when soil moisture is available but evapo-transpiration is not limiting might increase the probability of

seedling establishment. Such species might be seeded in fall, winter or spring.

One might hypothesise that if the first wet period is short, the seed may not germinate but might emerge after the next wet sequence (Watt, 1982). If the first sequence is adequate for germination of most or all of the seeds but is followed by a long drought, a "false start" would occur (Young *et al.*, 1970) and the seedlings would die. If the first wet sequence is adequate for seedlings to develop to a stage that can survive a drought-induced dormancy, a high percentage of the seedlings might survive a long drought (Wilson and Briske, 1979).

Germination and seedling emergence are direct responses to temperature and water availability. However, recent field observations have indicated that lovegrass emergence is also influenced by soil texture and planting depth. Currently recommended seeding depths for lovegrasses in the U.S.A. are 5 to 7 mm (Jordan, 1981), but the effects of interactions between seeding depths and soil texture on accession emergence have not been investigated.

Determining the response of lovegrass accessions to: (1) a temperature range, (2) several wet, dry, and rewet-day sequences and (3) soils with differing physical characteristics should make it possible to characterise germination, emergence and seedling survival requirements. These characteristics can then be used to correlate specific accessions with seasonal planting dates, precipitation probabilities and soils, and reduce some risks associated with rangeland seeding.

This paper describes results obtained in laboratory and greenhouse experiments designed to determine the effects of: (1) constant temperatures on germination, (2) selected wet-day, dry-day and rewet-day sequences on emergence and seedling survival and (3) soil texture on emergence of three South African grasses and one accession selected in the United States from boer lovegrasses originally introduced from South Africa. The research was conducted at Tucson, Arizona, U.S.A.

MATERIAL AND METHODS

Germination at constant temperatures

Fifty seeds of A-68, Cochise, A-84 and Catalina lovegrasses were sown on Whatman #3 filter paper and placed in plastic petri dishes. Approximately 7 to 9 ml of distilled water were added and seed were germinated at either 15, 18, 21, 24, 27 or 29 C on a thermogradient plate (Larsen, 1962) under alternating 15 h light and 9 h dark. Germination was considered complete when the seed radical was 15 mm in length. Germinated seeds were counted at 6 and 12 days after the addition of water.

Experimental design was a stratified randomised block because temperature was constant across the plate. There were six temperatures, one petri dish for each accession randomised within each temperature and the experiment was repeated six times (blocks). Accession germination means were compared across temperatures for each observation date by analysis of variance. When F values indicated significant main effects or interactions, a Duncan's New Multiple Range Test (Steel and Torrie, 1960) was used to separate means ($P \leq 0,05$).

Emergence, seedling survival and timing of precipitation

Cotton was placed in the bottom of 38×200 mm, tapered plastic cones. Each cone was filled with 210 g of dry 60 mesh silica sand to provide a uniform growth medium and eliminate undesirable seed contamination. Ten seeds of either A-68, Cochise, A-84 or Catalina lovegrasses were sown on the medium surface and covered with 2 to 3 mm of dry silica sand.

Water was applied with an overhead reciprocating spray boom sprinkling system (Frasier *et al.*, 1984). All cones initially received a 20 g water application or approximately 10 % water content by medium weight. Subsequent applications were adjusted and sufficient water added to return the cone water content to 10 % of the medium weight.

Water application was in predetermined wet-dry-wet sequences of either 1, 2 or 3 wet days, 7 dry days and 4 rewet days. All cones were watered at the beginning of the experiment, but due to the length of the wet day sequences the seven dry days ended on days 8, 9 and 10, and the four rewet days on 12, 13 and 14. Cone groups in dry day sequences were covered with 18-gauge galvanised sheet metal "splash roofs" when cone groups in wet day sequences were watered.

Emergence was complete when the first seedling leaf was 15 mm above the growth media surface and seedlings were counted daily. Peak emergence occurred on days 3 and 4, and varied between accessions and water rates. The end of the seven dry days represents peak seedling mortality and the end of the four rewet days represents seedlings which survived the seven dry days plus new seedlings.

Experimental design was a completely randomised block with six blocks. Each block included the three wet-day sequences, and five replicated and randomly distributed cones of each lovegrass. Block means were considered as replications. Means were compared across the three wet day sequences by analysis of variance at the following dates: (1) day 3, (2) day 4, (3) at the end of the seven dry days and (4) at the end of the four rewet days. When F values were significant ($P \leq 0,05$), a Duncan's New Multiple Range Test (Steel and Torrie, 1960) was used to separate means.

Emergence as influenced by soil texture and planting depth

Soils with textural characteristics common to arid and semi-arid regions of the south western U.S.A. and northern Mexico were collected in summer 1982. Pima silty clay loam soils were collected in the Santa Cruz flood plain 10 km south of Tucson, Arizona; Sonoita silty clay loam was collected in a creosotebush [*Larrea tridentata* (DC.) Cov.] stand 45 km south of Tucson and Comoro sandy loam was collected in a velvet mesquite [*Prosopis juliflora* var. *velutina* (Woot.) Sarg.] stand 47 km south east of Tucson. All soils were sampled from 0 to 150 mm depths. The three soils are classified as thermic Typic Torrifluvents or thermic typic Haplargids (Gelderman, 1972). Clay content of both the Pima and Sonoita silty clay loam soils was 20 %; however, the clay fraction of the Pima was 60 % montmorillonite and the Sonoita was 80 % kaolinite.

Soils were screened to 5 mm and thoroughly mixed. Soils were added to 150 × 150 mm tapered plastic pots; to 127, 122, 117, 112 and 107 mm depths above the pot base. Twenty-five pure live seed (P.L.S.) of one lovegrass accession were sown on the soil surface of each pot. Soils were added to 127 mm depths in all pots. Thus, seed were planted at 0, 5, 10, 15 and 20 mm depths.

Pots were subirrigated with distilled water to ensure that the soil surfaces were moist and undisturbed during the 14-day study. Emergence was considered complete when the first leaf was 15 mm above the soil surface in those pots where seed were planted at 5 to 20 mm depths, or when the first leaf was 15 mm above the soil surface and the seed radical had penetrated the soil in those pots in which seed were sown on the surface. Seedlings were counted daily.

Experimental design was a completely randomised block with six blocks. Each block contained 60 pots; four accessions, three soils and five planting depths. Since some accessions did not emerge from the 5 to 20 mm depths in some soils, analysis of variance was applied to each planting depth. Only one accession emerged from 10 to 20 mm depths in the Pima silty clay loam so data were subjected to analysis of variance with unequal sample numbers. When F values indicated significant main effects or interactions, a Duncan's New Multiple Range Test (Steel and Torrie, 1960) was used to separate means ($P \leq 0.05$).

RESULTS AND DISCUSSION*Germination at constant temperatures*

Lovegrass germination generally increased as temperature increased from 15 to 27 °C, and was similar at 27 and 29 °C after 6 days (Table 1). Germination of Catalina seed was greatest across all temperatures followed by

Cochise and A-84 with A-68 having the least. Germination of Catalina and Cochise seed was similar at 15 C, but germination of Catalina seed increased to 63 % at 18 C while germination of Cochise seed remained essentially unchanged. A-68 and A-84 seeds emerged when the temperature approached 21 C.

Lovegrass seed germination increased as temperature increased from 15 to 21 C, but was similar at 24 to 29 C after 12 days (Table 2). Catalina seed germination varied from 72 to 96 %, was greatest at 18 C and peak germination occurred at 9 to 12 degrees lower than with the remaining accessions.

TABLE 1

Mean¹ germination (%) of four lovegrass accessions at six constant temperatures (C) after six days.

Accession	Temperature						Accession ² Mean
	15	18	21	24	27	29	
A-68	0	0	3	34	45	33	19,2 ^d
Cochise	18	17	55	67	72	64	48,8 ^b
A-84	0	0	8	28	65	77	29,7 ^c
Catalina	19	63	81	81	84	87	69,2 ^a
Temperature Mean ³	9,2 ^c	20,0 ^d	36,7 ^c	52,5 ^b	66,5 ^a	65,2 ^a	

¹Each mean is the average of six replications of 50 seed

²Accession means followed by the same superscript are not different ($P \leq 0,05$)

³Temperature means followed by the same superscript are not different ($P \leq 0,05$)

TABLE 2.

Mean¹ germination (%) of four lovegrass accessions at six constant temperatures (C) after twelve days.

Accession	Temperature						Accession ² Mean
	15	18	21	24	27	29	
A-68	15	28	66	74	84	77	57,3 ^c
Cochise	50	51	79	79	79	68	67,7 ^b
A-84	2	13	44	54	72	85	45,0 ^c
Catalina	72	96	87	87	87	88	86,2 ^a
Temperature Mean ³	34,7 ^d	47,0 ^c	69,0 ^b	73,5 ^{ab}	80,5 ^a	79,5 ^a	

¹Each mean is the average of six replications of 50 seed

²Accession means followed by the same superscript are not different ($P \leq 0,05$)

³Temperature means followed by the same superscript are not different ($P \leq 0,05$)

The rapid and consistently high Catalina seed germination suggests that this accession is adapted over a greater temperature gradient and could be seeded and expected to germinate following warm or cool season moisture in warm temperate regions. Germination of Cochise and A-68 seeds was greatest at 27°C and inhibited at 29°C. Thus, these accessions should be seeded at higher elevations in spring or fall where temperatures are moderate. Germination of A-84 increased with increasing temperature and seeding should be limited to regions where summers are hot and moist.

Emergence, seedling survival and timing of precipitation

Catalina and Cochise seedling emergence occurred 2 days after the initial water applications on the three wet day sequences (Table 3). Catalina and Cochise seedling emergence increased rapidly between days 2 and 3 before either A-68 or A-84 had emerged. Cochise seedling emergence was similar on both 1 and 2 wet-day sequences but approximately 50 % greater on the 3 wet-day sequence. Catalina seedling emergence was similar to Cochise on the 1 wet-day sequence, 50 % greater on the 2 wet-day sequence and seedling emergence was similar on the 3 wet-day sequence.

Initial peak densities occurred on day 4 and either 1, 2 or 3 days after the

TABLE 3

Emergence (%) of four lovegrass accessions following either one, two or three wet-days, seven dry-days and four wet-days.

Accession	Days Wet	Days after initial wet day			
		3*	4	End Seven Dry-Days	End Four Wet-Days
A-68	1	0 ^c	0 ^f	0 ^c	10 ^d
	2	0 ^c	0 ^f	0 ^c	8 ^d
	3	0 ^c	4 ^{de}	0 ^c	10 ^d
Cochise	1	17 ^b	25 ^c	22 ^a	43 ^b
	2	17 ^b	52 ^b	47 ^b	51 ^{ab}
	3	40 ^a	52 ^b	48 ^b	55 ^a
A-84	1	0 ^c	0 ^f	0 ^c	21 ^c
	2	0 ^c	1 ^c	0 ^c	27 ^c
	3	0 ^c	8 ^d	0 ^c	21 ^c
Catalina	1	19 ^b	21 ^c	18 ^c	47 ^{ab}
	2	40 ^a	56 ^a	51 ^a	58 ^a
	3	40 ^a	56 ^a	51 ^a	59 ^a

*Means in columns followed by the same superscripts are not different ($P \leq 0.05$)

initial water application (Table 3). A-68 and A-84 seedlings began to emerge on the 3 wet-day sequence and those of A-84 on the 2 wet-day sequence. More than 50 % of the Catalina and Cochise seed produced seedlings on the 2 and 3 wet-day sequences, whereas half that number were present on the 1 wet-day sequence.

No A-68 or A-84 seedlings survived following the 7 dry days (Table 3), but seedlings of both emerged during the 4 rewetting days. Catalina seedling mortality was less than Cochise, differences ($P \leq 0.05$) were significant at the 2 and 3 wet-day sequences, but not at the 1 wet-day sequence. However, both Catalina and Cochise seedlings exhibited similar seedling drought tolerant characteristics.

Catalina and Cochise seedling emergence after the final 4 rewet days varied from 8 to 9 % on the 2 and 3 wet-day sequences (Table 3). Catalina seedling emergence increased to 62 % and the emergence of Cochise increased to 40 % on the 1 wet-day sequence which indicates that seed which were moist for only a short time are viable and may germinate when soil water conditions improve.

Jordan (1968; 1969; 1970; 1971 and 1972) sowed these four lovegrass accessions in spring and summer, measured daily precipitation and recorded seedling survival at the end of the summer growing period at three sites and over five years in Arizona, U.S.A. Seedlings emerged but failed to survive in 13 of the 15 planting years. Cox and Jordan (1983) documented the short- and long-term lovegrass density and production changes in two planting years where adult plants had persisted for more than 10 years. Precipitation events began in late summer in both planting years, there were two to three consecutive precipitation events which deposited more than 50 mm, and following storms occurred at 4 to 14 day intervals for 30 to 40 days.

Emergence as influenced by soil texture and planting depths

Germination of the lovegrass accessions on surface soils averaged 23 or 24 seed/pot. A-68 and A-84 seedling radicals grew horizontally, fewer than 28 % penetrated the soil surfaces of the Pima and Sonoita silty clay loams, and those which did not penetrate the surface died within 48 h.

Catalina seedling emergence was greatest, Cochise intermediate, and A-68 and A-84 were least, across all soils when seed were sown on the soil surfaces (Table 4). Lovegrass emergence was similar on Sonoita and Comoro soils, but fewer seedlings emerged from Pima which contained the expanding clay fraction.

A-68 seedlings failed to emerge when seeds were planted below the surface in the three soils (Table 4). Emergence of Catalina seedlings was 50 % more than A-84 and Cochise across the three soils at 5 mm depths. Acces-

TABLE 4

Mean¹ emergence of four lovegrass accessions sown at five depths in three soils.

Depth (mm)	Accession	Soil			Accession ² Mean
		Pima Silty Clay Loam	Sonoita Silty Clay Loam	Comoro Sandy Loam	
0	A-68	4	6	8	6,0 ^c
	Cochise	7	13	16	12,3 ^b
	A-84	1	7	11	6,3 ^c
	Catalina	13	20	20	17,7 ^a
	Soil Mean ³	6,2 ^b	11,5 ^a	13,7 ^a	
5	A-68	0	0	0	0,0 ^c
	Cochise	5	5	4	4,7 ^b
	A-84	2	6	7	5,0 ^b
	Catalina	5	15	15	11,7 ^a
	Soil Mean	3,0 ^b	6,5 ^a	6,5 ^a	
10	A-68	0	0	0	0,0 ^c
	Cochise	0	3	5	2,7 ^b
	A-84	0	4	5	3,0 ^b
	Catalina	5	7	11	7,7 ^a
	Soil Mean	1,2 ^c	3,5 ^b	5,2 ^a	
15	A-68	0	0	0	0,0 ^c
	Cochise	0	4	4	2,7 ^b
	A-84	0	0	0	0,0 ^c
	Catalina	2	8	12	7,3 ^a
	Soil Mean	0,5 ^b	3,0 ^a	4,0 ^a	
20	A-68	0	0	0	0,0 ^c
	Cochise	0	3	3	2,0 ^b
	A-84	0	0	0	0,0 ^c
	Catalina	2	8	8	6,0 ^a
	Soil Mean	0,5 ^b	2,7 ^a	2,7 ^a	

¹Each mean is the average of six replications of 25 P.L.S.²Accession means by depth, within column followed by the same superscripts are not different ($P \leq 0,05$)³Soil means, within a row followed by the same superscripts are not different ($P \leq 0,05$)

sion emergence was similar for the sandy loam and the Sonoita silty clay loam, and inhibited in silty clay loam soils with expanding clay.

Cochise and A-84 seedlings failed to emerge from the Pima silty clay

loam when planted at 10 mm and greater depths (Table 4). Only Catalina seedlings emerged from the Pima soil when seeds were planted at 15 and 20 mm depths. Catalina seedling emergence was significantly ($P \leq 0,05$) more than Cochise on Pima soils. However, there were no differences ($P \leq 0,05$) in average lovegrass emergence in these soils.

Catalina boer lovegrass emergence was greater from all depths (0 to 20 mm) as compared to the other lovegrasses (Table 4). Greater emergence can be expected from surface sown seeds; however, the soil surface dries rapidly in summer and it is desirable to plant seed below the surface where moisture persists longer (Tadmore and Cohen, 1968). The majority of A-68 and A-84 seed radicals failed to penetrate the soil surfaces when surface sown. The greater number of Catalina and Cochise seedlings emerging from greater depths suggests that a greater portion of seed reserves may be initially allocated for shoot growth, even though seed sizes of the respective grasses are similar (Jordan, 1981).

The presence of an expanding clay fraction reduced lovegrass emergence from the surface and 5 mm depths and inhibited emergence from 10 to 20 mm depths; with the exception of Catalina boer lovegrass (Table 4). Lovegrass seedling emergence, of those accessions which did emerge, was similar in non-expanding silty clay loam and sandy loam soils, with the exception of seeds planted at 10 mm.

The number of Catalina seedlings emerging from all soils and depths, and the number of Cochise seedlings emerging from non-expanding silty clay loam and sandy loam soils at all depths indicates that these grasses have a greater emergence potential as compared to A-68 and A-84. Expanding silty clay loams are often, but not always, found in alluvial plains while sandy loams are usually found near mountainous or foothill areas in the south western U.S.A. Summer storm numbers and intensities usually decrease with decreasing elevation (Jordan, 1981). Therefore, seeding failures are assumed to be associated with the lack of precipitation and proper emphasis has not been given to soil texture, clay fractions and planting depths.

CONCLUSIONS

These results demonstrate the importance of temperature, timing of precipitation and soil texture on the germination, emergence and seedling survival of four lovegrasses. The more important findings show that: (1) A-68 Lehmann lovegrass and A-84 boer lovegrass germination is inhibited by cool temperatures, emergence is slow, seedlings are not drought tolerant and both must be planted near the soil surface which dries rapidly in summer and (2) Catalina boer lovegrass and Cochise lovegrass germinate at

cooler temperatures, emerge quickly, seedlings are drought tolerant and both may be planted at greater depths than A-68 and A-84. However, Catalina is generally superior to Cochise.

Catalina was developed in the U.S.A. from boer lovegrass collections made in South Africa (Wright, 1971). Catalina germination and seedling characteristics suggest that this accession will establish on a greater variety of sites in arid and semi-arid regions of the world; as compared to A-68, A-84 and Cochise lovegrasses.

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A REVISION OF THE GENUS *MIMETES* SALISB. (PROTEACEAE)

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ABSTRACT

Twelve species are recognised in this the only complete taxonomic treatment of *Mimetes* (Proteaceae) since it was studied in *Flora Capensis* in 1912. The genus is endemic to the south western and southern Cape, where it is found mainly in montane habitats on sandstone-derived soils. *Mimetes* is characterised by extreme specialisation of the inflorescences into compound structures. The flowers are almost exclusively bird pollinated.

UITTREKSEL

'N HERSIENING VAN DIE GENUS *MIMETES* SALISB. (PROTEACEAE)

In hierdie, die eerste volledige hersiening van *Mimetes* (Proteaceae) sedert dit in *Flora Capensis* (1912) ondersoek is, word twaalf spesies erken. Die genus is endemies aan die suid-westelike en suidelike Kaap waar dit hoofsaaklik in berghabitat op gronde met 'n sandsteenoorsprong gevind word. *Mimetes* word gekenmerk deur uiterste spesialisasie van die bloeiwyses in saamgestelde strukture. Die blomme is byna uitsluitlik voëlbestuif.

Key words: *Mimetes*, Proteaceae, southern Cape, taxonomic revision, modified compound inflorescences, bird pollination.

INTRODUCTION

Mimetes is a small well-defined southern African genus of the Proteaceae, comprising twelve species which are endemic to the south western and southern Cape.

R. A. Salisbury established *Mimetes* in 1807 when he proposed a major subdivision (into additional genera) of the old Linnaean genus *Leucadendron*. At the time he assigned *Leucadendron cucullatum* L. and *Leucadendron hirtum* L. to *Mimetes* Salisb. Two years later, writing in Joseph Knight's *Proteaeae* (1809), Salisbury published the first important account of *Mimetes*, increasing the number of known species to seven. The following year Robert Brown (1810) also upheld seven species in *Mimetes* but caused

considerable confusion when he remodelled the generic concept so as to include those taxa which Salisbury had placed in another newly created genus, *Diastella* Salisb. (Rourke, 1976).

Meisner (1856), expanded the concept of *Mimetes* even further, including at sectional level, not only *Diastella* Salisb., but also *Orothamnus* Pappe ex Hook. [as section *Pseudomimetes* Endl. and section *Orothamnus* (Pappe ex Hook.) Meisn., respectively].

A more natural, and in my opinion, a better classification was eventually restored by Phillips and Hutchinson (1912) who re-instated Salisbury's original concept of *Mimetes* Salisb., upholding *Orothamnus* Pappe ex Hook., and *Diastella* Salisb., as separate genera.

Apart from the publication of three additional species by Phillips, between 1911 and 1923, no further taxonomic work on the genus was published until October 1982, when a large-format review and semi-popular account of the genus was issued (Rourke, 1982), with life-size colour illustrations of each species by Thalia Lincoln. As this costly publication may not be readily accessible except in a few major botanical libraries, a more formal taxonomic treatment of *Mimetes* is given here.

MORPHOLOGY

Inflorescence

Throughout this paper the term inflorescence has been used when referring to the highly complex flowering structure which develops towards the end of each flowering shoot and is formed out of an aggregation of numerous axillary capitula and their variously modified subtending leaves. Although Johnson and Briggs (1975) have used the term "conflorescence" for these much condensed structures in certain Australian Proteaceae, I have preferred to retain the term inflorescence for both simple and compound structures.

The formation of a *Mimetes* inflorescence commences with the development of numerous sessile capitula, each arising in the axil of one of the uppermost leaves on a shoot, a few centimetres below the apical meristem. During the flowering and fruiting phases, the apical meristem terminating each shoot (conflorescence) remains dormant. Dehiscence of the fruits is followed by abscission of the sessile axillary capitula, after which the shoot's apical meristem recommences a new annual growth flush on which axillary capitula will again develop to form the subsequent seasons compound inflorescence. In *Mimetes* this compound inflorescence (conflorescence) has developed along several lines of specialisation, all of them adaptations to ornithophily.

Modification for pollination

Mimetes are almost entirely dependent on birds to effect cross pollination. Bees, flies and other small hymenoptera may occasionally be responsible for a chance act of cross pollination, but their effective role in this process is probably minimal.

Nectar is the chief attractant. Nectar droplets are secreted into the perianth tube from four hypogynous scales (nectaries) at the base of each flower. Malachite sunbirds (*Nectarinia famosa*), Lesser double collared sunbirds (*Nectarinia chalybea*) and Orange Breasted sunbirds (*Nectarinia violacea*) are the principal sunbird species feeding on and cross-pollinating *Mimetes*, with the latter species being most frequently in attendance. The considerably larger Cape Sugarbird (*Promerops cafer*) is also a regular visitor to certain species, accumulating pollen on its throat and forehead while foraging. Collins (1982) indicates that *Promerops cafer* is a major pollen vector in the Betty's Bay area, at least in *Mimetes hirtus*.

Through a reduction in the number of individual flowers comprising an axillary capitulum, often coupled with the modification of a brightly pigmented subtending leaf over-arching or clasping each axillary capitulum, the axillary capitula cease functioning as multi-flowered inflorescences, becoming instead functionally equivalent to single flowers, here termed pseudanthia. *Mimetes* pseudanthia have evolved to form several morphological "blossom types" (sensu Faegri and van der Pijl, 1966), each having somewhat different values as pollinator attractants.

Brush Type

The least specialised pseudanthium is of the Brush Type as seen in *Mimetes hirtus*, *Mimetes capitatus*, *Mimetes palustris*, *Mimetes saxatilis*, *Mimetes hottentoticus* and *Mimetes stokoei*. Here styles, pollen presenters, perianths and often involucre bracts are large, prominent and brightly coloured with red, white or yellow contrasting tones. Symmetrically developed involucre bracts surround the several-flowered axillary capitula (pseudanthia). There is no change in the shape or pigmentation of the subtending leaves which remain green throughout the flowering period when the brush-like pseudanthia are at their most colourful (Fig. 1, A)

Tube Type

A more advanced stage derived from the above is the Tube Type, exemplified by *Mimetes pauciflorus*, which has axillary capitula (pseudanthia) reduced to a mere three flowers surrounded by short involucre bracts. Tightly adpressed, bright yellow floral bracts enfold the styles forming a straight but narrow tube from which only the perianth limbs and pollen presenters protrude (Fig. 1, C). In this case each pseudanthium mimics the



FIG. 1.

Compound inflorescences in *Mimetes* showing various adaptations to ornithophily; (A) pseudanthia of the "Brush Type" on *M. capitulatus*; (B) pseudanthia of the "Gullet Type" in *M. cucullatus*. For the sake of clarity, some of the lower leaves have been removed in B, including the leaf subtending the lowermost pseudanthium, viewed here anteriorly; (C) three-flowered pseudanthia of the "Tube Type" in *M. pauciflorus*.

corolla of a long-tubed flower, such as *Erica*, for example. It would appear that the reduction to only three flowers per pseudanthium would scarcely favour large-scale seed production in *Mimetes pauciflorus*, despite the fact that this drastic morphological modification has evidently resulted in a functionally effective tube flower, conducive to attracting pollinators. However, negative as the reduction in flower number per pseudanthium may seem, it is more than compensated for by an enormous increase in the number of axillary capitula in each inflorescence; usually to over three times the number characteristic of other species.

Gullet Type

The third, and by far the most advanced development, is the Gullet Type in which the pseudanthia mimic and are functionally equivalent to bilaterally symmetrical flowers found in families like Lamiaceae, Scrophulariaceae or Acanthaceae (Vogel, 1954; Faegri and van der Pijl, 1966).

Both *Mimetes cucullatus* and the related *Mimetes fimbriifolius* are unique among *Mimetes*, in that the involucre bracts surrounding their axillary capitula (pseudanthia) are asymmetrical, forming bilabiate involucres. The anterior bracts are elongated and enlarged, while the posterior bracts are markedly shorter (usually one-third of the length of the anterior bracts). Moreover, each axillary capitulum is partially enfolded by the hooded, forwardly deflected subtending leaf of the capitulum above it; the whole forming a bilaterally symmetrical gullet-shaped pseudanthium. During flowering the elongating styles spring free of the perianths pressing onto the hooded subtending leaf above, by now brilliantly coloured with red pigments, but later, after anthesis, reverting to a green foliage leaf (Figs 1, B and 2).

Architecturally and functionally, each pseudanthium and its superposed subtending leaf parallels a single bilabiate zygomorphic flower such as is found in families (e.g. Lamiaceae) where this type of floral morphology typically occurs. Indeed, the parallelism in *Mimetes* is such that Porsch (1931), an early commentator on ornithophily in *Mimetes* (who saw no living flowering specimens) actually considered the axillary capitula to be single flowers. Vogel (1954) regarded the specialised "Gullet Type" of pollination mechanism in certain *Mimetes* as the most advanced level of ornithophily in the southern African Proteaceae, a view-point with which the present author concurs.

SYSTEMATIC POSITION AND RELATIONSHIPS

Mimetes, together with eleven other South African proteaceous genera, is presently placed within the Subtribe Proteinae of the family Proteaceae (Johnson and Briggs, 1975). A chromosome number of twelve is common to

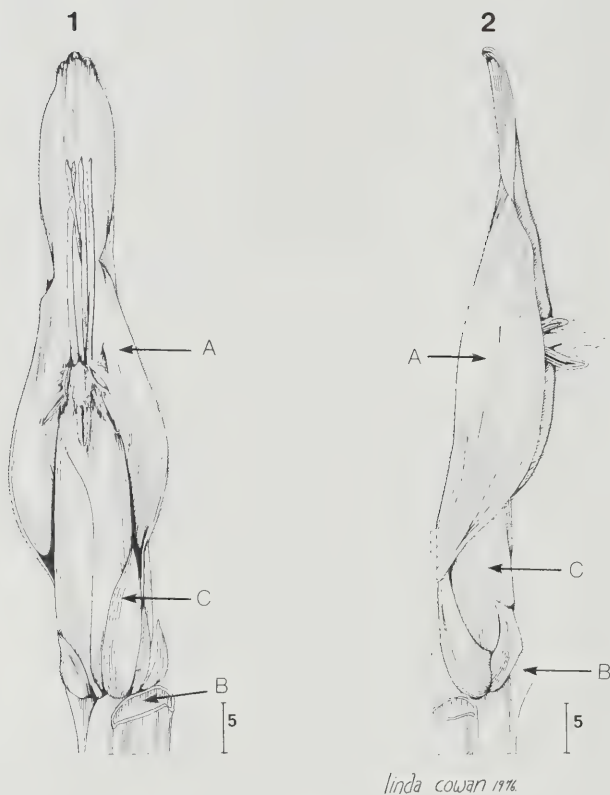


FIG. 2.

Single, detached pseudanthium of *Mimetes fimbriifolius*, consisting of a four-flowered axillary capitulum and conduplicate anteriorly deflected superposed subtending leaf (A) as seen anteriorly (1) and laterally (2). The scar of the leaf subtending the capitulum is in the anterior right position (B). Only the enlarged anterior involucre bracts (C), are visible.

all component genera of the subtribe. However, even within this relatively homogeneous subtribal grouping, several obvious subsidiary clusterings may be discerned. *Leucospermum*, *Diastella*, *Mimetes* and *Orothamnus* form one such cluster, united by the presence of several common morphological features. The most fundamental unifying factor linking these four genera is the form and structure of their fruits. These are ovoid to cylindric, minutely

puberulous achenes ridged on the adaxial surface. Grafting compatability between all four genera is another indication of their affinities. (A discussion on the relationships between these genera will be given in a forthcoming paper on *Orothamnus*.)

There is a particularly close alliance between *Mimetes* and *Leucospermum*, as both have axillary capitula clustered towards the apices of their flowering shoots, while many of the species in both genera have toothed leaves or, if not, then entire leaves with a single apical callosity. It is but a short step from a *Leucospermum*-like ancestral form with multi-flowered pedunculate axillary capitula, to a progenitor of *Mimetes* with few-flowered sessile axillary capitula (Fig. 3).

In speculating on the possible origin and affinities of *Mimetes*, it is not unreasonable to suggest that *Mimetes* has evolved from a *Leucospermum*-like ancestor and that the genus has subsequently undergone reduction and specialisation, particularly in respect of its complex compound inflorescences, where most of the adaptations are related to pollination mechanisms, especially ornithophily.

DISTRIBUTION

Mimetes exhibits a distribution pattern typical of many endemic genera within the Cape floristic kingdom; namely, having the greatest species concentration in the mountainous, high rainfall area of the extreme south west, centered around the Kogelberg Forest Reserve (Levy, 1964; Goldblatt, 1978).

The genus occurs over most of the south western and southern Cape from the Cold Bokkeveld, near Porterville in the north, southwards to the Cape Peninsula, then eastwards along the Hottentots Holland, Langeberg, Outeniqua and Tsitsikamma mountains to an area a few kilometres beyond Formosa Peak on the coastal ranges; with isolated populations on Rooiberg, the Klein Swartberg and Kouga mountains on the inland ranges (Fig. 4). Although half the known species have been recorded from within the approximately 24,000 hectare Kogelberg Reserve, this area cannot be assumed to be the centre of origin for the genus; yet it is certainly a major centre of speciation. Great habitat diversity, coupled with a multitude of microclimates, have provided opportunities for speciation to take place there.

Moist mesic conditions appear to be an ecological prerequisite of the genus. In this regard it is probable that climatic fluctuations since the early Pleistocene have had a significant influence on the distribution and evolution of *Mimetes*. During cooler, moister periods, distribution ranges would probably have expanded, while in warmer drier periods they would have contracted, isolating populations from each other.

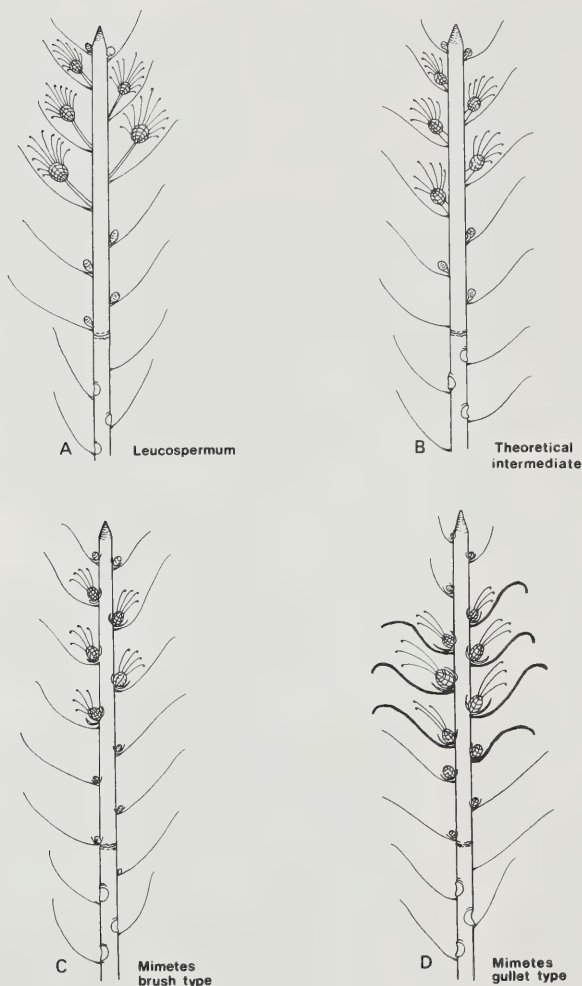


FIG. 3.

Schematic representation of flowering shoots in *Leucospermum* (A) and *Mimetes* (C and D), with a theoretical intermediate between the two genera (B). Abscission scars of the previous year's capitula are indicated on the penultimate growth flush. The axillary capitula in *Leucospermum* (A) are pedunculate. In *Mimetes* (C and D), the axillary capitula are sessile and together with the apical portion of the current year's growth flush, form a compound inflorescence. In (C) the compound inflorescence is formed of "Brush Type" pseudanthia, while (D) is formed of "Gullet Type" pseudanthia.

Strong indications of such events can be seen from the distribution of *M. cucullatus* (Fig. 7), the most widespread and polymorphic species in the genus. Abundant on the coastal Langeberg, it is also found in a few relatively mesic but isolated refugia on the arid interior ranges; these being on Rooiberg, an inselberg in the middle of the Little Karoo; on the Klein Swartberg, above Ladismith and in the Kouga Mountains, Baviaanskloof.



FIG. 4.
Distribution range of the genus *Mimetes*.

Such a disjunct pattern suggests that this species had a wider distribution at some stage in the past and that increasing aridification has reduced its range on the drier interior mountain chains to the few widely isolated refugia, where it presently survives.

Mimetes cucullatus is not only the most widespread, polymorphic species in the genus, it is also the most successful biologically, and displays the most advanced modifications in respect of floral morphology and inflorescence structure. The character of fire resistance resulting from the development of a woody, persistent lignotuber, as well as a high degree of ecological adaptability, have probably also contributed to the species' successful spread.

Mimetes Salisb. in Parad. Lond. sub. t.: 67 (April 1807); Knight, Cult. Prot.: 64 (1809); R. Br. in Trans. Linn. Soc. Lond. 10: 108 (1810)—pro parte; Meisn. in DC., Prodr. 14: 262 (1856)—pro parte excluding Sect. *Orothamnus* Meisn. & Sect. *Pseudomimetes* Endl.; Phill. & Hutch. in Fl.

Cap. 5: 643 (1912); Adamson & Salter, Fl. Cape Penins.: 322 (1950); Dyer, Gen. of S.A. Fl. Pl. 1: 43 (1975); P. van der Merwe in Landbou Weekblad 8 July 1977: 82, 83, 85 (1977), and in Landbou Weekblad 15 July 1977: 82, 83 (1977); Paterson Jones in Veld & Flora 64 (3): 78 (1978); Rourke & Lincoln, *Mimetes*, Tiyan Publishers, 1-177, Oct. 1982.

Mimetes Salisb. Sect. *Eumimetes* Endl., Gen. Pl. suppl. 4 (2): 78 (1848).

Hypophyllocarpodendron Boerehaave, Index Alter Plant. 2: 205, 206 (1720).

Lectotype: *M. hirtus* (L) Salisb. ex Knight

Shrubs or small trees. *Leaves* alternate; sessile, ascending, subimbricate to imbricate, oblong, oblong-elliptic, oval or rhombic, entire with a thickened apical callus or dentate with several apical teeth. *Inflorescence* cylindric, an aggregation of sessile axillary capitula; capitula 3 to 22-flowered, surrounded by an involucre of small, oval oblong or lanceolate bracts. *Involucral bracts* small and woody or enlarged, brightly coloured, fleshy to papyraceous. Flowers bisexual, regular. *Perianth* cylindric in bud; tube very short, cylindric, quadrangular or bulbous, usually glabrescent; claws filiform, pubescent; limbs linear, acute to acuminate, glabrescent or pubescent. *Anthers* linear, acute, sessile, arising from base of perianth limb. *Ovary* slender pubescent, scarcely differentiated from style, with a single terminally attached ovule. *Style* terete, curved while elongating but straight after anthesis. *Pollen presenter* linear-acute to acuminate, or with a cylindric, ovoid-capitate or conic-capitate apex, usually geniculate or annulate at junction with style. *Hypogynous scales* 4, obtuse or linear-filiform. *Fruit* an ovoid or cylindric achene, broadly or narrowly introrse at base, glabrous to minutely puberulous. *Chromosome number* $n=12$ (de Vos, 1943).

DISTRIBUTION

A genus of twelve species endemic to the south western and southern Cape Province; confined mainly to the coastal mountains, ranging from Porterville and the central Cold Bokkeveld in the north west to the Tsitsikamma mountains in the vicinity of Storms River in the south east, and with inland outliers in the Kouga mountains (Baviaanskloof Forest Reserve), being the most easterly record.

DIAGNOSTIC CHARACTERS

Mimetes is distinguished by its numerous *few-flowered* (3-22-flowered) *sessile* axillary capitula.

DERIVATION OF NAME

Mimetes is derived from a Greek substantive, meaning a mimic or imitator; "this genus resembling several others in its foliage" according to

Salisbury (1809). The word mimic (i.e. an actor or dancer) has a masculine gender, since in ancient Greece both male and female theatrical parts were taken by men. Salisbury (1809) clearly construed it as masculine, using masculine endings for the specific names of the various *Mimetes* he described. Robert Brown (1810), as well as Phillips and Hutchinson (1912), preferred to interpret *Mimetes* as feminine. I intend to follow the original (and, I believe, correct) usage by adopting masculine terminations for the specific names of *Mimetes*.

KEY TO THE SPECIES

1. Leaves densely silvery-sericeous
 2. Pollen presenter capitate
 3. Involucral bracts lanceolate-acuminate (7) **hottentoticus**
 - 3' Involucral bracts oval to rounded (8) **stokoei**
 - 2' Pollen presenter linear-subulate
 4. Involucral bracts thin-textured, papyraceous and brown when dry, outer surface glabrous or nearly glabrous (except for ciliate margins) (4) **splendidus**
 - 4' Involucral bracts thick and cartilaginous, woody when dry, outer surface cinereously sericeous.
 5. Leaves elliptic to broadly elliptic, growth habit shrubby at maturity with main branches occasionally dichotomous; range extends north and north east of Sir Lowry's Pass to Hottentots Holland mountains, Grabouw, Nuweberg, French Hoek, Villiersdorp and to Riviersonderend (5) **argenteus**
 - 5' Leaves lanceolate, growth habit arborescent at maturity with stout main trunk and dense rounded crown of short repeatedly dichotomous branches, bark thick; range extends south of Sir Lowry's Pass, Steenbras to Kogelberg State Forest ... (6) **arboreus**
- 1' Leaves variously pubescent or glabrous but not silvery-sericeous.
 6. Pollen presenter capitate or swollen at apex.
 7. Leaves acute, often tapering abruptly, entire (12) **capitulatus**
 - 7' Leaves broadly elliptic to oblong, apex obtuse or rounded, often tridentate, rarely entire (3) **saxatilis**
 - 6' Pollen presenter linear-subulate at apex but sometimes annulately swollen in middle.
 8. Capitula 3 (very rarely 4)-flowered (10) **pauciflorus**
 - 8' Capitula 5 or more-flowered.
 9. Leaves entire.
 10. Styles 30–35 mm long (11) **palustris**
 - 10' Styles 50–55 mm long (9) **hirtus**
 - 9' Leaves dentate at apex
 11. Leaf margins densely ciliate fringed, leaves 40–70 mm long. Growth habit arborescent. Confined to Cape Peninsula (2) **fimbrifolius**
 - 11' Leaf margins either glabrous or pubescent but not ciliate fringed. Leaves 22–55 mm long. A multiple-stemmed shrub with subterranean lignotuber (1) **cucullatus**

(1) *Mimetes cucullatus* (L.) R. Br. in Trans. Linn. Soc. Lond. **10**: 107 (1810); Meisn. in DC., Prodr. **14**: 263 (1856); Rourke in *Mimetes*: 19–29 (1982).

Leucadendron cucullatum L., Sp. Pl. ed 1: 93 (1753); Berg., Descript. Plant. Cap.: 14 (1767). Type: Boerhaave, Index Alter Plant. (2): 206, t. 206 (1720)—lectotype.

Protea cucullata (L.) L., Mant. Alt.: 189 (1771); Thunb. Diss. Prot.: 23 & 49 (1781).

Mimetes lyrigera Salisb. ex Knight in Knight, Cult. Prot.: 65 (1809); Phill. & Hutch. in Fl. Cap. **5**: 645 (1912);—nom. superfl. Type: As for *Leucadendron cucullatum* L.

Mimetes cucullatus (L.) R. Br. var. *brevifolia* Meisn. in DC., Prodr.: 263 (1856). Type: No type cited or designated—description only.

Mimetes cucullatus (L.) R. Br. var. *ludwigii* Meisn. in DC., Prodr. **14**: 263 (1856). Type: *Ludwig 36* in herb. Reg. Stuttgart—not traced, apparently lost or destroyed, but clearly identifiable from description.

Mimetes ludwigii Steudel ex Meisn., in DC., Prodr. **14**: 263 (1856)—nom. nud.

Mimetes mixta Gandoger in Bull. Soc. Bot. Fr. **48**: 93 (1901). Type: Prope Groot Houhoek ad Potrivier necnon ad Klynrivier, July, *Zeyher 1478* in herb. Gandoger (LY, holo.!; photo, NBG).

Mimetes cucullatus R. Br. forma *dregei* Gandoger in Bull. Soc. Bot. Fr. **48**: 93 (1901). Type: No type cited or designated—description only.

Mimetes dregei Gandoger & Schinz in Bull. Soc. Bot. Fr. **60**: 51 (1913). Type: “Cap, (*Drège* sub nom. *M. cucullatae* R. Br.)”, in herb. Gandoger (LY, holo.!; photo, NBG).

Mimetes cucullatus R. Br. forma *laxa* Gandoger in Bull. Soc. Bot. Fr. **48**: 93 (1901). Type: “Appelsbosch et Woormansbosch, *Zeyher 3693*”, in herb. Gandoger (LY, holo.!).

Mimetes laxifolia Gandoger & Schinz in Bull. Soc. Bot. Fr. **60**: 51 (1913). Type: “Appelsbosch et Woormansbosch, *Zeyher 3693*”, in herb. Gandoger (LY, holo.!; photo, NBG).

Mimetes schinziana Gandoger in Bull. Soc. Bot. Fr. **60**: 51 (1913). Type: “cap ad Rivier Zonder Ende, *Schlechter 5646*” (Z, holo!).

PRE-LINNAEAN CITATIONS

Leucadendros Africana, s. *Scolymocephalus*, angustiori folio, apicibus tridentatis. Pluk., *Opera 2 (Almagest)*: 212 tab. 304 fig. 6 (1696).

Hypophyllocarpodendron; foliis inferioribus apice trifido, rubro, superioribus penitus rubris, glabris. Boerhaave, *Index Alter Plant.* (2): 206, t. 206 (1720).

Scolymocephalus africana foliis angustis, brevioribus, tribus in summitate denticulis, capitulis foliolis interceptis Herman, *Cat. Plant Afr.*: 20 (1737).

Protea foliis lanceolatis obtusis foliis involventibus apice tridentato-callosis. Royen, *Prod. Lugd. Bat.*: 184 (1740).

Leucadendron folii cuneiformibus apice tridentato—callosis summis ultra florem protensis. Wachendorff, *Hort. Ulraj*: 203 (1747).

Diese blom groeytis vogtige Plaatse drierd voet hoog bloeyd in Octobr. No date or author, folio 125, *Index Plant. et Animal* in *Africana Mus.*, Jhb.

An erect shrub 1–2 m in height, multiple-stemmed at base, the numerous branches arising from a stout subterranean lignotuber. *Branches* upright, 3–8 mm in diam., usually simple, only occasionally dichotomous or branched, densely cinereously villous, tending to glabrescent later. *Leaves* very narrowly to broadly oblong-elliptic 25–55 mm long, 5–20 mm wide; leaves subtending axillary capitula narrowly obpandurate becoming anteriorly conduplicate, cucullate, clasping the capitulum immediately below; truncate at base, apex tridentate rarely entire, puberulous at first, soon glabrous. *Inflorescence* cylindric, 60–100 mm long, 40–70 mm wide, topped by a suberect coma of reduced narrowly oblong reddish flushed leaves, *Capitula* 4–7-flowered, subtended by a reddish or yellow-flushed, cucullate, anteriorly conduplicate leaf either entire or tridentate at apex. *Outer involucre* bracts glabrous, unequally developed, forming a clasping bilabiate involucre; anterior bracts large, elliptic-acuminate 15–30 mm long, 3–12 mm wide; posterior bracts lanceolate-acuminate 8–10 mm long, 1.5–3 mm wide; inner involucre bracts narrowly lanceolate-acuminate, margins sericeously ciliate. *Floral bracts* linear, acuminate to subulate, 6–10 mm long. *Perianth* 35–40 mm long, curved adaxially in bud; tube inflated, 1 mm long, glabrous, claws 10 mm long; filiform puberulous to sparsely sericeous; limbs linear-acute scarcely differentiated from claws, densely sericeous. *Style* 45–50 mm long. *Pollen presenter* linear-subulate 5–7 mm long, annulately thickened at junction with style, apex sharply acuminate, stigmatic groove terminal. *Ovary* oval 1 mm long, densely sericeous. *Hypogynous scales* subulate, fleshy, 2 mm long.

DISTRIBUTION AND HABITAT

The most widely distributed and variable species in the genus, *M. cucullatus* is found on Table Mountain Sandstone formations in most mountain ranges in the south western and southern Cape, from sea level to 1 200 m,

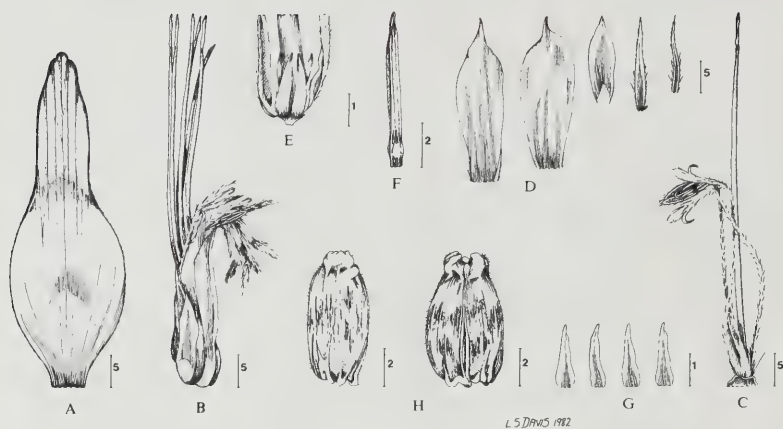


FIG. 5.

Mimetes cucullatus (A) leaf; (B) axillary capitulum, lateral view; (C), single flower; (D) involucral bracts; (E) base of perianth; (F) pollen presenter; (G) hypogynous scales; (H) fruits. Scale lines in millimetres.

though mainly below 500 m. It is particularly common in moist coastal areas between Cape Hangklip and Bredasdorp, often forming large local stands. However, it tends to be scattered or occasional in drier inland habitats.

Isolated outliers occur in moist refugia within otherwise arid montane habitats like the Rooiberg in the Little Karoo, the Klein Swartberg, above Ladismith, and at a single locality in the Kouga Mountains (Baviaanskloof Forest Reserve); the latter site being the most isolated and also the most easterly for the species. Such a distribution pattern suggests that *M. cucullatus* may have been more widely distributed in the past but that increasing aridification at the northern and eastern perimeters of its range has greatly reduced its occurrence there.

This species is characterised by the presence of a stout subterranean lignotuber and is consequently exceptionally fire resistant. Repeated burning maintains *M. cucullatus* as a compact shrub of rounded appearance, with numerous upright unbranched stems arising from the rootstock.

Older specimens, if left unburnt for many years, eventually attain two metres with straggling, occasionally branched stems, but this condition is seldom encountered due to the frequency of fire.

Profuse flowering occurs mainly on vigorous young growth which regenerates from the lignotuber in the first few years after a fire. Thereafter, flowering diminishes progressively every year as the regrowth matures and the aerial stems become senescent. Time of flowering is also partly dependent on the occurrence of fire, as well as seasonality. Flowering may thus take place locally at any time of the year, though mainly between August and March.

VARIATION

Mimetes cucullatus is highly polymorphic. Dwarf, less robust forms appear randomly within the species' distribution range, displaying generally smaller inflorescences and shorter narrower leaves (Fig. 6). Although genetically stable, their sporadic occurrence, as well as the presence of a whole range of intermediates, precludes the meaningful recognition of infraspecific taxa based on leaf dimensions and inflorescence size. Colour variants having yellowish-green subtending leaves in the inflorescence instead of reddish-orange coloured subtending leaves, are also encountered. However, both yellow and red variants grow sympatrically and are always linked by a series of pale yellowish-orange intermediates, again precluding the recognition of clearcut infraspecific taxa based on inflorescence colour.

DIAGNOSTIC CHARACTERS

In *M. cucullatus* the involucre surrounding each axillary capitulum is asymmetrical due to an enlargement and elongation of the anterior involucral bracts to about twice or three times the length of the posterior bracts. The resultant structure is a "bilabiate" involucre characteristic of *M. cucullatus* and the related *M. fimbriifolius*. Apart from very obvious differences in growth habit, the two species are readily distinguished by the fully mature leaves. In *M. cucullatus* they are shorter (22–55 mm long) and glabrous, while the leaves of *M. fimbriifolius* are longer (40–70 mm long) and thickly fringed with dense white cilia.

SPECIMENS EXAMINED

CAPE PROVINCE—3219 (Wuppertal): Olifants River Valley, Grootfontein, south east of Grassruggens (-CC), Oct., *Oliver* 4086 (STE); Sandy plateau on Twenty Four Rivers mts., above Porterville, Oct., *Esterhuysen* 16149 (BOL). —3318 (Cape Town): On Table Mountain (-CD), 24.1.1811, *Burchell* 661 (K); Kirstenbosch, north boundary, Aug., *Esterhuysen* 17382 (BOL); Twelve Apostles, Feb., *Pillans s.n.* (BOL); Jonkershoek (-DD), Aug., *Bos* 292 (STE); Jonkershoek beside Langrivier catchment area, Feb., *Walters* 6 (STE). —3319 (Worcester): Between Rosendalfontein and Visgat (-AA) Nov., *Pillans* 9644 (BOL); North east boundary of Visgat, upper Olifants River Valley, Dec., *Rourke* 1502 (NBG); Above Tulbagh waterfall (-AC), Oct., *Phillips* 525 (SAM, K); Witzen-

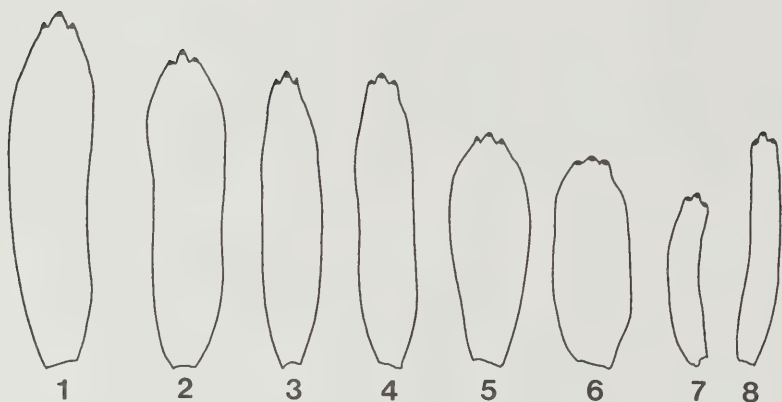


FIG. 6.

Variation in the leaves of *M. cucullatus*. The leaf outlines shown here are representative samples taken from the following herbarium collections, all in NBG: (1) Middlemost 1988; (2) Rourke 973; (3) Rourke 1273; (4) Barker 9131; (5) Compton 9143; (6) Rycroft 2863; (7) Rourke 1502; (8) Wurts 279.

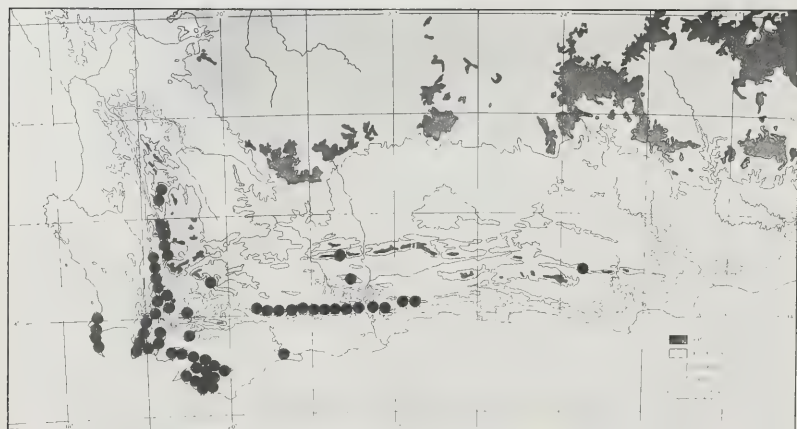


FIG. 7.

Distribution of *Mimetes cucullatus*.

berg, near Tulbagh, 17/4/1811, *Burchell* 8692 (K); Prope Ceres (-AD), Dec., *Bolus* s.n. (BOL); Mitchells Pass near toll house, April, *Marloth* 1695 (NBG); Hugo's Berg, NW of Prince Alfred's Hamlet, June, *Oliver* 4868 (STE); Bain's Kloof, Wellington (-CA), Oct., *Lewis-Grant* 2618 (PRE); Du Toitskloof mts. (-CC), 30/11/1827, *Drège* s.n. (P); French Hoek, Oct., *Barker* 4178 (NBG, BOL); Waterkloof beneath Sneeuwkop on Rawsonville side of mountain (-CD), April, *Le Roux* s.n. (NBG 19437); Upper north slopes of Jonaskop, Nov., *Rourke* 973 (NBG); Lower slopes of Naudesberg, Koo (-DA), Nov., *Barker* 9131 (NBG).

—3320 (Montagu): Langeberg, near Montagu (-CC), Oct., *Esterhuysen* 23865 (BOL); Kogmans Kloof, Oct., *Barnard* 688 (SAM); Lower south slopes of Leeuwrivierberge, Swellendam (-CD), Sept., *Esterhuysen* 27869 (BOL); Base of the Crown Mountain, Swellendam, Aug., *Wurts* 280 (NBG); Tradouw Pass (-DC), Oct., *Levy* 655 (STE); Barrydale mts., Oct., *Barnard* s.n. (SAM 29012); Strawberry Hill, Heidelberg (-DD), Sept., *D. J. van der Merwe* s.n. (STE 10201); Grootvadersbos, below Lemonshoek, Nov., *Rourke* 1273 (NBG).

—3321 (Ladismith): Klein Swartberg, on southern aspect of Toorkop (-AC), Nov., *Vlok* 759 (NBG); South side of Elandsberg, Klein Swartberg, Ladismith (-AD), July, *Wurts* 1398 (NBG); Rooiberg, along ridge road to Bailey Peak (-CB), April, *H. C. Taylor* 9659 (STE); Rooiberg, Ararat Ridge, Dec., *H. C. Taylor* 9772 (STE); Garcias Pass, Riversdale (-CC), *Bolus* 11362 (PRE); Mountains above Corente River, Riversdale, June, *Muir* 388 (PRE); Grootwaterval, north slopes of Langeberg between Muiskraal and Cloetes Pass (-CD), May, *Rourke* 1339 (NBG); North slopes of Cloetesberg between Grootplaas and Woëska (-DC), Dec., *Rourke* 1511 (NBG); Carbonaatjieskraal at entrance to Attaquaskloof area (-DD), Nov., *Oliver* 4147 (STE, NBG).

—3322 (Oudtshoorn): Ruytersbosch, Mossel Bay, south aspect (-CC), Sept., *Van Niekerk* 118 (BOL); Jonkersberg, Oct., *Phillips* 1082 (BOL); Top of Robinson Pass, *Acoks* 20585 (PRE); Robinson Pass, Dec., *Maguire* 794 (NBG); Geelhoutboomberg, George, on south slopes (-CD), Aug., *von dem Bussche* 17 (NBG).

—3324 (Willowmore): Kouga mountains, next to forestry track on watershed between Diepriver and Drinkwaterkloof, 9/12/1982, *J. H. J. Vlok* 521 (SAAS, NBG).

—3418 (Simonstown): In humidis in monte Muizenberg (-AB), March, *Bolus* 4198 (BOL); Near Smitswinkel, Cape Peninsula (-AD), April, *Compton* 8703 (NBG); Vergelegen (-BA), Oct., *Barker* 9092 (NBG); Sir Lowry's Pass, Sept., *Rodin* 1356 (PRE, K); Betty's Bay (-BD), Sept., *Parker* 4517 (BOL, K); Pringle Bay, Jan., *Rourke* 1022 (NBG); Palmiet River Mouth, Dec., *Pillans* 8518 (BOL); Sunny Seas, Betty's Bay, Nov., *Rourke* 1501 (NBG, PRE, MO).^v

—3419 (Caledon): In clivis oriental. mont. Hottentotsholland prope Grabouw (-AA), *Bolus* 4198 (BOL); Caledon side of Houw Hoek Pass, *Storv* 3084 (PRE); Above Caledon Baths Hotel (-AB), Sept., *Hutchinson* 506 (K, PRE); Hawston (-AC), Sept., *Marloth* 9201 (STE); Hermanus, Dec., *van der Merwe* 2031 (STE); Road to Elim, 15 miles from Stanford (-AD). Fernkloof Nature Reserve, Hermanus, south slopes of Platberg, Sept., *Rourke* 1743 (NBG, PRE, MO), Oct., *Gillet* 4492 (PRE); Genadendal, in Montibus (-BA), *Schlechter* 9844 (PRE, L. PENN. PH), Riviersonderend (-BB), Oct., *Schlechter* 5646 (PRE); Danger Point mountain (-CB), Jan., *Leighton* 1597 (BOL); Ten miles from Gansbaai on Elim road (-DA), Sept., *Richmond* 25 (NBG); Elim hills, Bredasdorp t.-DB), Aug., *Compton* 9143 (NBG); Geelrug, east-facing slopes and flats, March, *Oliver* 3350 (STE); Springfontein, south of homestead (-DD), Dec., *Rourke* 1175 (NBG).

—3420 (Bredasdorp): One mile from Bredasdorp on Agulhas road (-CA), Sept., *Richmond* 15 (NBG); Mountain above Bredasdorp village, Nov., *Barker* 10869 (NBG); Middle south slopes of Potteberg (-BC -BD), Oct., *Pillans* 9339 (BOL).

(2) *Mimetes fimbriifolius* Salisb. ex Knight in Knight, *Cult. Prot.*: 65 (1809); Palmer & Pitman, *Trees of S.A.* 1: 552, 533 (1972); Rourke in *Mimetes*: 33–39 (1982). Type: Mountains near Simons Bay, *J. Niven* (not traced); therefore Boerhaave, *Index Alter. Plant.* 2: 205, t. 205 (1720) also cited in original descript., taken as lectotype.

Mimetes hartogii R. Br. in *Trans. Linn. Soc. Lond.* 10: 108 (1810); Meisn. in DC., *Prodr.* 14: 263 (1856); Adamson & Salter, *Fl. of Cape Penins.*: 327 (1950); M. Kidd, *Wild Flowers of the Cape Peninsula*: t. 34 No. 4 (1950). Type: In collibus prope Simons Bay, Oct. 1801, *R. Brown s.n.* (BM, holo.!).

Mimetes cucullatus (L.) R. Br. var. *hartogii* (R. Br.) Phill. in *Fl. Cap.* 5: 646 (1912).

Protea cucullata β. Lam. *Tab. Encycl. Meth. Bot.* 1: 239 (1792). Type: Based on a specimen so annotated in herb Lamarck (P—LA!).

PRE-LINNAEAN CITATIONS

Hypophyllocarpodendron; foliis lanuginosis; in apice trifido, rubro, quasi florescens. Boerhaave, *Index Alter Plant* 2: 205, t. 205 (1720).

arb: afr: montana fl. rub: Kreupelboom groeyd op het plat der bergen 8 ag voet hoog bloeyd in October: no date or author, folio 32, *Index Plant. et Animal* in *Africana Mus.*, Jhb.

A small tree 2.5–5 m tall with a dense rounded, spreading crown up to 5 m in diam., trunk stout, 250–600 mm in diam., covered with dark grey irregularly fissured corky bark up to 25 mm thick. *Branches* stout, stocky 10–12 mm in diam., repeatedly dichotomous, densely velutinous, eventually glabrous. *Leaves* densely ascending imbricate, oblong to elliptic-oblong, 40–70 mm long, 12–22 mm wide, truncate and sessile at base, apices obtuse, tridentate; densely velutinous initially, eventually glabrescent, but margins densely fimbriate with white cilia; leaves subtending axillary capitula obpanurate, becoming cucullate, anteriorly conduplicate, clasping capitulum immediately below. *Inflorescence* broadly cylindric, 60–80 mm long, 60–70 mm wide. *Capitula* 4–7-flowered, subtended by a reddish flushed obpanurate cucullate conduplicate leaf, obtuse and tridentate at apex. *Outer involucral bracts* unequally developed, forming a bilabiate clasping involucre, minutely puberulous but villous proximally; anterior bracts 2 or 3, broadly elliptic, acuminate, 35–40 mm long, 12–16 mm wide; posterior bracts narrowly lanceolate, acuminate, 15–25 mm long, 3–5 mm wide. *Floral bracts* linear-subulate, very densely sericeous, 10 mm long, 1 mm wide. *Perianth* 40–45 mm long; tube inflated, hyaline, glabrous, 3 mm long; claws filiform, minutely puberulous; limbs linear-cymbiform, acute, outer

surface villous. *Style* 55–60 mm long. *Pollen presenter* 8–10 mm long, very narrowly ellipsoid-acuminate, slightly constricted proximally and minutely annulate at junction with style; stigmatic groove oblique, on anterior surface of acuminate apex. *Ovary* sericeous, 1–2 mm long, not differentiated from style. *Hypogynous scales* 1,5 mm long, subulate, fleshy. *Fruits* broadly ovoid, 8 mm long 5 mm wide.

DISTRIBUTION AND HABITAT

Mimetes fimbriifolius is endemic to the Cape Peninsula, ranging from Table Mountain in the north, where it is becoming increasingly rare, to Cape Point in the south, where the species is still relatively abundant. At the northern end of its range it rarely occurs below 300 metres but at more southerly localities, such as the Cape of Good Hope Nature Reserve, specimens can be found growing almost at sea level. Although this species occurs at lower elevations, it displays a marked preference for rocky montane habitats. The finest specimens will always be found among craggy Table Mountain Sandstone outcrops where they appear to enjoy a measure of protection from fire. In a recent study it was estimated that the total population consists of some 30,000 individuals (Ryan, 1982).

At maturity, *M. fimbriifolius* assumes the form and stature of a small tree. A clearly defined trunk, 250 to 600 mm in diameter, usually branches at about 0,5 m above soil level to form a dense, rounded crown of short, repeatedly dichotomous, interlocking branchlets. Very old specimens in sheltered positions attain up to 5 m in height but on exposed sites the average height is 3 m.

The trunk and upper branches are protected by a thick layer of corky bark, varying from 15 mm thick on the larger upper branches to as much as 25 mm thick on the trunk. Consequently, mature specimens are able to survive veld fires, regenerating from terminal shoots on the upper branches. Trees are rare in open fynbos. Therefore the arborescent life form, so typical of this species, has inevitably made it one of the conspicuous and characteristic elements in the Cape Peninsula's flora.

Mimetes fimbriifolius is the largest, as well as the longest-lived *Mimetes*. Though not always attaining the same height as *M. arboreus*, it has a much greater spread when mature. Growth is very slow: on average twelve to fourteen years elapse between seed germination and first flowering, but some seedlings on favourable sites may flower in their sixth year. There is no precise data available yet on the longevity of this species although circumstantial evidence suggests that ages of one hundred years are frequently attained before certain trees succumb to natural senescence. Nevertheless, most specimens probably seldom exceed sixty years of age.

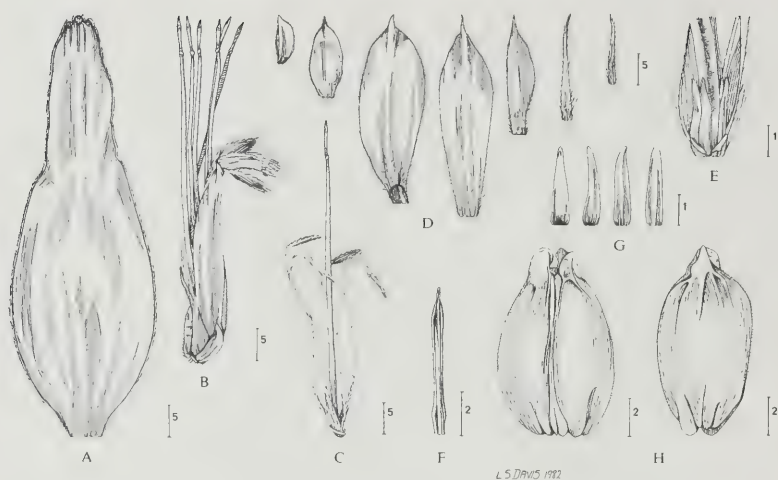


FIG. 8.

Mimetes fimbriifolius (A) leaf; (B) axillary capitulum, lateral view; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) pollen presenter; (G) hypogynous scales; (H) fruits. Scale lines in millimetres.

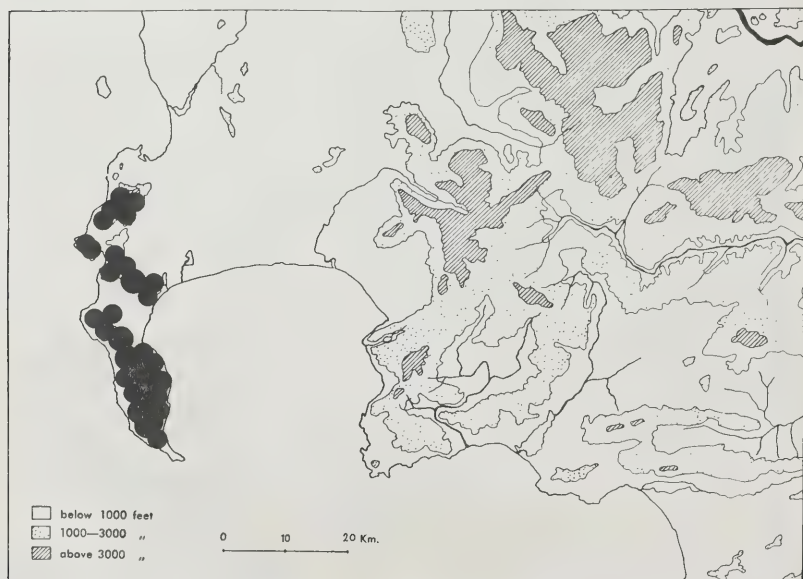


FIG. 9.

Distribution of *Mimetes fimbriifolius*.

Flowering is often rather erratic resulting in odd inflorescences being produced at almost any time of the year. However, the main flowering period commences in about July, reaching a peak in September and continuing until as late as December. Ripe fruits are shed over a period of several months, commencing in January.

DIAGNOSTIC CHARACTERS

Mimetes fimbriifolius is readily distinguished from the related *M. cucullatus* by its arborescent growth habit and the presence of a thick fringe of white pubescence on the leaf margins. Moreover, the leaves are from 22–55 mm long in *M. fimbriifolius*, perceptibly longer than in *M. cucullatus*.

SPECIMENS EXAMINED

CAPE PROVINCE—3318 (Cape Town): Table Mountain, rocky slope at head of Diamond Ravine (-CD), May, *Esterhuysen 18600* (BOL); Table Mountain, Jan. 24th 1811, *Burchell 661* (K); Tafelberg, Kastelberg, Sept., *Zeyher 4681* (NBG, PRE); Table Mountain, near Oudekraal, April, *Zeyher s.n.* (SAM 43690); Slangkuil near Woodhead Saddle, Nov., *Froembling 318* (NBG); Stinkwater, above Van Kampsbay, Oct. & Nov., *Zeyher 4681* (NBG, SAM); Castle Rock, Kirstenbosch, March, *Compton 15597* (NBG).

—3418 (Simonstown): Simonstown (-AB), Nov., *Meebold 12426* (NY); Garlands-kloof, Cape of Good Hope Nature Reserve, Aug., *H. C. Taylor 6884* (STE); Mountains near Witsands, May, *Lotsy & Goddijn 1487* (L); Slangkop, Oct., *Wolley-Dod 1802* (BOL); Mountains between Fish Hoek and Simonstown, Aug., *Hutchinson 151* (BOL, BM,K); Simons Bay hill, July 1847, *Alexander Prior s.n.* (K); In collibus prope Simon's Bay, Oct. 1801, *R. Brown s.n.* (BM); Muizenberg, Sept. 1838, *Krauss s.n.* (NBG); Silvermine valley, behind old silvermine, Aug., *Rourke 1090* (NBG); Karbonkelberg, south east slopes, Oct., *Rourke 928* (NBG); Kommetjie hills, Sept., *Steyn 654* (NBG); Karbonkelberg, *Esterhuysen 26251* (BOL); Kapteins Peak south of Karbonkelberg, above Hout Bay, Dec., *Rourke 1767* (NBG, MO); Smitswinkel (-AD), Nov., *Marloth 340* (PRE); Boy's Kraal River, Jan., *Baker 1179* (BM).

- ✓ (3) *Mimetes saxatilis* Schlechter ex Phillips in Kew Bull. 1911: 84 (1911); Phill. & Hutch. in Fl. Cap. 5: 645 (1912); P. van der Merwe in Landbou Weekblad 15 July 1977: 83 (1977); Rourke in *Mimetes*: 43–47 (1982); Types: Elim, 24/4/1896, *Schlechter 7716* (K! BM! BOL!); Mierkraal, 25/4/1897, *Schlechter 10521* (K, lecto!; STE!, PRE!, L!, BM!, PH!, is-lectos.).

Mimetes saxatilis Schlechter ined., m.s. annotations on Schlechter's collecting tickets.

Erect shrub 1–2.2 m tall, with a single main trunk branching into several upright, rather sparsely branched stems. Branches 5–10 mm in diam., densely velutinous, later becoming glabrous and prominently marked with leaf scars. Leaves subpatent to loosely ascending imbricate, elliptic to

broadly oval, 35–50 mm long, 17–30 mm wide; velutinous, later glabrescent, margins fimbriate; apices subacute, entire to tridentate. *Inflorescence* cylindric, 50–100 mm long, 50–60 mm wide, topped by an erect to suberect coma of green elliptic to oval leaves. *Capitula* 14–22-flowered, subtended by a flat, green undifferentiated foliage leaf. *Outer involucral bracts* loosely arranged, broadly lanceolate to ovate, acute, 10–25 mm long, 6–8 mm wide, glabrous but margins fimbriate; inner series narrowly lanceolate, 12–25 mm long, 2–5 mm wide. *Floral bracts* linear, acuminate, 12–22 mm long, 1–2 mm wide, margins very densely villous. *Perianth* 30–35 mm long, yellow; tube slightly inflated, glabrous, 2 mm long; claws filiform, sparsely villous; limbs linear-cymbiform, 5 mm long, glabrous or nearly glabrous with a few scattered hairs. *Anthers* sessile. *Style* slender, pale yellow terminally, 30–50 mm long, glabrous. *Pollen presenter* annulate at junction with style, becoming quadrangular-cylindric and then ovoid-acute terminally; stigmatic groove terminal. *Ovary* ovoid, minutely sericeous, 1 mm long. *Hypogynous scales* linear-subulate, 2 mm long. *Fruits* cylindric, 6–8 mm long, 3–4 mm wide.

DISTRIBUTION AND HABITAT

Mimetes saxatilis is endemic to the southernmost tip of Africa, occurring in a narrow belt along the coast between Franskraal in the west and Cape Agulhas, whence its range extends a few kilometres eastwards to Struis Bay. The total east-west range is little more than one hundred kilometres, while most populations are found within three kilometres of the coastline at elevations between sea level and one hundred and eighty metres.

Mimetes saxatilis is unusual in that it is an exclusively lowland species favouring an exposed coastal environment. It has very specific edaphic requirements, growing only on limestone deposits or on alkaline, limestone-derived soils. Its natural habitat is wholly restricted to coastal limestone outcrops of the Alexandria Formation, Tertiary to Recent in geological origin.

Scattered stands occur at many places within its range. Sometimes they are locally dominant, occasionally forming small thickets but nowhere is this species really common. It seems to grow best when lodged in potholes or crevices in the soft white limestone, its roots penetrating deeply into the limey bedrock. When fully grown *M. saxatilis* is between one and two metres in height.

Flowering takes place between July and December, but is often very erratic, apparently being significantly influenced by rainfall. A rather low mean annual rainfall of about 400 mm is experienced in most parts of species' range. During very dry seasons when precipitation falls well below this figure, flowering is tardy, while in some instances the flowers may abort before opening. Late August is usually the peak of the flowering season and

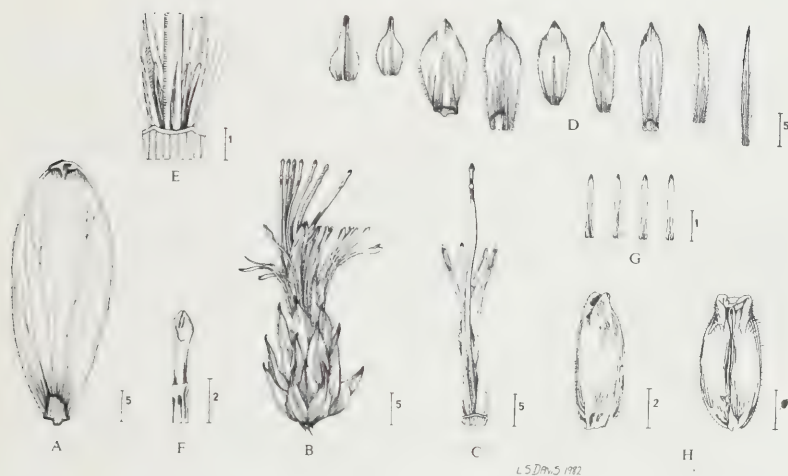


FIG. 10.

Mimetes saxatilis (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) pollen presenter; (G) hypogynous scales; (H) fruits. Scale lines in millimetres.

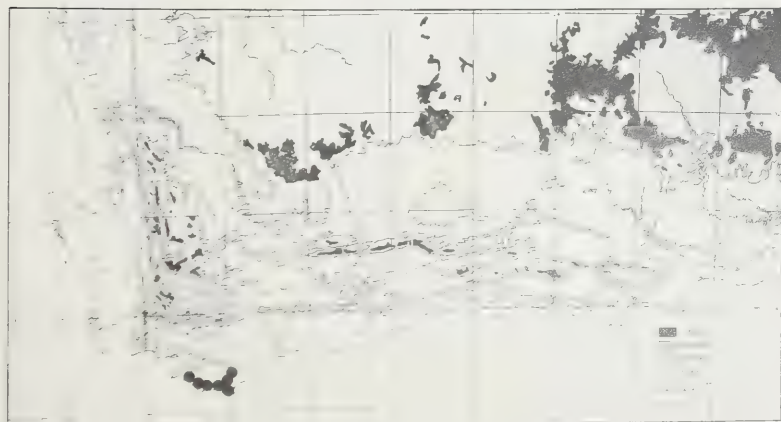


FIG. 11.

Distribution of *Mimetes saxatilis*.

if average or above average winter rains have been experienced, profuse flowering usually follows. Ripe fruits are shed approximately nine months after flowering.

DIAGNOSTIC CHARACTERS

This species is distinguished by its pale yellow involucre bracts, glabrous on the outer surface, though with ciliate margins, by its yellow perianth and style and by its distinctive pollen presenter, cylindric-quadrangular basally and ovoid-acute terminally. The large number of flowers—between twelve and twenty-two—in each axillary capitulum, is also an important characteristic of *M. saxatilis*.

SPECIMENS EXAMINED

CAPE PROVINCE—3419 (Caledon): Limestone hills inland from Pearly Beach (-DA), Oct., *Esterhuysen 32991* (BOL); Klein Hagelkraal, near Pearly Beach, Sept., *Rourke 1661* (NBG, PRE, MO); 1 mile S S W of Waterford near Pearly Beach, Nov., *Boucher 867* (STE); Farm Uintjieskuil, June, *van Breda & Admiraal 1872* (PRE); Kleyn Hagel Kraal, Aug., *Rourke 512* (NBG); Groothagelkraal, limestone hills, May, *Williams 2502* (NBG); Mierkraal (-DB), April, *Schlechter 10521* (K, STE, PRE, L, BM PH); Elim, April, *Schlechter 7716* (Bol, K, BM); Rietfontein, foot of hill behind homestead (-DD), Sept., *C.A. Smith 3175* (PRE); Soetanytsberg, Oct., *H. C. Taylor 144* (BOL); Soetanytsberg, Dec., *Rourke 1020* (NBG); Soetanytsberg, between Quoin Pt. and L'Agulhas, June, *Williams 24* (NBG). —3420 (Bredasdorp): Bredasdorp Poort (-CA), Sept., *Compton 14692* (K, NBG, PRE); Bredasdorp hills, Aug., *Compton 9182* (NBG, STE, BOL); Hill ¼ mile east of Agulhas (-CC), Dec., *Pillans 8148* (BOL); Hills near Struis Bay, *Herre s.n.* (STE 30211); Northumberland Point, Aug., *Acoccks 22637* (PRE); Cape Agulhas on hill behind the lighthouse, Oct., *Rourke 946* (NBG); Hills above St. Mungo Bay, Agulhas, Sept., *Garside 4681* (SAM, K).

- ✓ (4) *Mimetes splendidus* Salisb. ex Knight in Knight, Cult. Prot.: 66 (1809); Phill. & Hutch. in Fl. Cap. 3: 646 (1912); J. L. du Plessis and P. van der Merwe in Landbou Weekblad, 14 July 1978: 20–21 (1978); van der Kooy in Veld & Flora 64 (3): 84 (1978); Rourke in *Mimetes*: 351–57 (1982). Type: Moist alpine places, Barbierskraal, *Niven 75* (K, lecto.!; and in herb. J. E. Smith, LINN, isolecto!).

Mimetes hibbertii R. Br. in Trans. Linn. Soc. Lond. 10: 109 (1810); Meisn. in DC., Prodr. 14: 264 (1856). Type: Moist alpine places, Barbierskraal, *Niven* in herb. Banks, Hibbert & Lambert—not traced but duplicates seen in herb. Salisbury (K!) and J. E. Smith (LINN!).

Protea hibbertii (R. Br.) Poir. Encycl. Meth. Bot. Suppl. 4: 568 (1816).

Mimetes integrus Hutch. in Fl. Cap. 5: 647 (June 1912); Hutch. in Kew Bull. 1912: 282 (Aug. 1912). Type: Banks of the Sonder Einde River near Apples Kraal, *Zeyher 3688* (K, holo.!; SAM, iso.!).

Mimetes mundii Ecklon m.s. on specimen in SAM.

An erect rather sparsely branched shrub to 2.5 m in height with a single main trunk to 60 mm in diam. Bark thin, smooth, grey with horizontal striations. *Branches* stiffly erect when young, usually very sparsely branched, 6–10 mm in diam., sericeous; drooping in old shrubs. *Leaves* sessile; ascending-imbricate, broadly lanceolate to elliptic, 40–55 mm long, 12–25 mm wide, densely silvery-sericeous, apices subacute, usually dentate with 3–4 reddish-amber callus teeth, occasionally entire with a single apical callosity. *Inflorescences* 80–120 mm long, 60–80 mm wide, flattened apically with a coma of small reduced, silvery-pink flushed leaves. *Capitula* 10–14-flowered, subtended by a prominently cucullate, basally auriculate, anteriorly conduplicate leaf, flushed brilliant orange-pink during anthesis. *Involucral bracts* broadly ovate to obovate-oblong, obtuse, glabrous to minutely puberulous, margins ciliate; papyraceous in texture when dry; pale yellowish-amber when fresh, subhyaline incurved and loosely clasping the base of the perianths, 12–18 mm long, 7–10 mm wide. *Floral bracts* linear, 12–16 mm long 2 mm wide, densely sericeous. *Perianth* 30–35 mm long; tube slightly inflated, 3–4 mm long, glabrous; claws filiform, sericeous but crisped proximally; limbs 8–10 mm long, linear-cymbiform, acute, densely sericeous, but crinite apically. *Style* 45–55 mm long, straight, filiform. *Pollen presenter* linear-acute, 5–7 mm long, annulate at junction with style, stigmatic groove obliquely terminal. *Ovary* ovoid, 1 mm long, densely sericeous. *Hypogynous scales* linear-subulate, 2 mm long, bright orange in live state. *Fruits* narrowly ellipsoid, 6–7 mm long, 4–5 mm wide.

There has been considerable confusion regarding the identity of *Mimetes integrus* Hutch., a name which has often been erroneously associated with *M. argenteus* Salisb. ex Knight, as well as having been applied to a species here enumerated as *M. arboreus* Rourke.

Mimetes integrus Hutch., was based on single sheet of a Zeyher collection at Kew, namely, Zeyher 3688, from the banks of the Sondereinde River near Apples Kraal. After examining Hutchinson's annotated type at Kew, and also material in other herbaria under the type number, it is now clear that Zeyher 3688 is a mixed collection made up of both *M. argenteus* and *M. splendidus*. Hutchinson's type—a single flowering branch—is clearly conspecific with *Mimetes splendidus* Salisb. ex Knight, while other specimens distributed under Zeyher 3688 (e.g. at BOL and NY) are *Mimetes argenteus* Salisb. ex Knight. Duplicates of Zeyher 3688 cannot therefore automatically be assumed to be isotypes of *M. splendidus*.

DISTRIBUTION AND HABITAT

This is a relatively wide-spread *Mimetes*. Its range extends over a distance of some three hundred kilometres from west to east in a more or less



FIG. 12.

Mimetes splendidus (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) pollen presenter; (G) hypogynous scales; (H) fruits. Scale lines in millimetres.

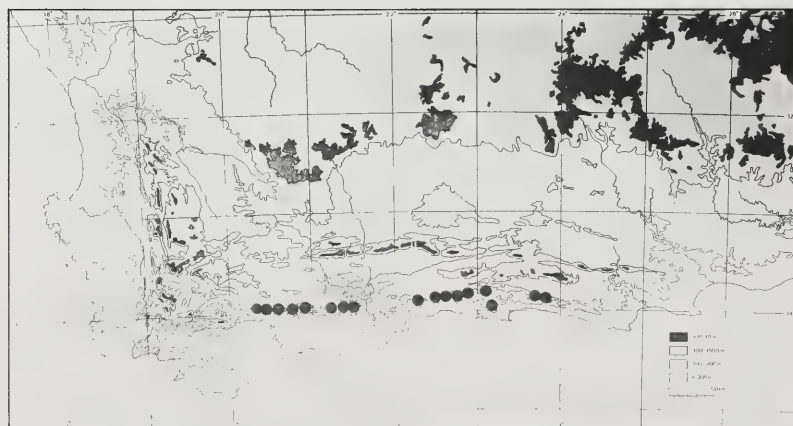


FIG. 13.

Distribution of *Mimetes splendidus*.

straight line along the coastal mountains of the southern Cape, from the Clock Peaks above Swellendam to Rondebos in the Storms River State Forest. Between these points populations occur sporadically in the Langeberg, Outeniqua and Tsitsikamma mountains.

Nowhere is this species common. Sometimes it may be quite solitary or found in small groups of about half a dozen individuals. Only at a few localities are larger stands encountered, consisting of between thirty or forty specimens growing in close proximity to each other.

Mimetes splendidus is a strictly montane species with specialised ecological requirements; in particular, a high yet consistent moisture supply throughout the year. It is confined to the upper south- and south east-facing slopes of the coastal ranges, mentioned previously, always above the 600 m contour, but occurs most frequently at elevations between 1 000 and 1 200 m, on steep slopes of black, peaty, acid soil in dense tall fynbos, often more than two metres in height.

Mimetes splendidus eventually attains a maximum height of about two and a half metres. Characteristically slender and sparse in its growth habit, it has a single main trunk, which only rarely reaches 50 to 60 mm in diameter at the base, even on larger old specimens. Like several other *Mimetes* which regenerate from seed, *M. splendidus* develops rapidly, matures early and senesces by about its twentieth year. By their fifteenth year, most specimens are straggly, their lower branches defoliated. Few survive beyond twenty years, while an occasional individual may persist for as many as twenty-five years, though such longevity is exceptional.

Flowering takes place in mid-winter with the peak of the flowering season being from late May until early July. Ripe fruits are shed approximately eight months after flowering, usually in January or February, depending on the elevation and microclimate of each particular population.

DIAGNOSTIC CHARACTERS

Among silvery-leaved *Mimetes*, this species is easily distinguished by its large, obtuse, broadly ovate to obovate-oblong, involucre bracts which are thin-textured and glabrous or nearly glabrous on the outer surface. In the live state these bracts are yellowish-amber in colour but in dried herbarium specimens they are brown and papery in texture. *Mimetes splendidus* is also unusual among other silver *Mimetes* in that its leaves are almost always tridentate at the apices.

SPECIMENS EXAMINED

CAPE PROVINCE—3320 (Montagu): Swellendam State Forest, south slopes of 12 o'clock Kop (-CD), Aug., Haynes 656 (STE); Langeberg at Swellendam, south west to western aspect of 12 o'clock peak, May, Brouwer 1785 (STE); South side of

The Crown, June, *Wurts 182* (NBG); In silva mont. Grootvadersbosch (-DD), Oct., *Zeyher s.n.* (BOL); Grootvadersbosch, Zuurbraak, June, *E. W. Moodie s.n.* (BOL); Lemoenshoek Peak, south slopes, Sept., *Esterhuysen 10504* (BOL, PRE, NBG); Mountains of "Groot Vader Bosch and Traduberg", *Bowie s.n.* (BM); Grootvadersbosch, *Pappe s.n.* (SAM 19852).
 —3321 (Ladismith): South west of Aasvoelkranz above Oudebosch, Garcia Forest Reserve (-CC), June, *Roux 282* (NBG); Upper part of Kampsche Berg, Riversdale (-CD), Sept., *Muir 3342* (BOL, PRE).
 —3322 (Oudtshoorn): Outeniqua mountains, Wittefontein Forest Station near George (-CD), Aug., *Petzer s.n.* (STE); Lower part of Cradockberg, Sept., *Burchell 6020* (K); Moist alpine places, Barbierskraal (-DC), *Niven 75* (K, LINN); At Knysna (-DD), Nov. (in fruit), *Werdermann & Oberdieck 885* (K); Hooeberg, south east slopes, Oct., *Keet s.n.* (STE 13113, PRE).
 —3323 (Willowmore): Buffelsnek, Knysna (-CC), Oct., *H. C. Taylor 585* (NBG); Stormsvlei State Forest, on a spur east of Rondebos (-DD), Aug., *P. Slingsby s.n.* (NBG 119988).
 —3423 (Knysna): Plettenberg, Knysna (-AB), Aug., *M. M. Mardon s.n.* (NBG 104635).

- ✓ (5) *Mimetes argenteus* Salisb. ex Knight in Knight, Cult. Prot.: 67 (1809); Phill. & Hutch. in Fl. Cap. 5: 647 (1912); Phill. in Flower. Pl. S. Afr. 3: t. 128 (1924); Bolus, Barclay and Steer, A Second Book of S.A. Flowers: 104–107 (1936); Rourke in *Mimetes*: 61–67 (1982) Type: "mountain rivulets near the river Zonde Einde", *Niven 74* (K, lecto.; and in herb. J. E. Smith in LINN, isolecotype!)

Mimetes massonii R. Br. in Trans. Linn. Soc. Lond. 10: 109 (1810); Meisn. in DC., Prodr. 14: 264 (1856). Type: Montibus prope French Hoek, *Masson s.n.* in herb. Banks. There is no sheet so labelled at BM but another sheet labelled "*Mimetes massonii* Prom bon spei Mr. Masson" in Brown's hand, taken as lectotype (BM!).

Protea massonii (R. Br.) Poir., Encycl. Meth. Bot. Suppl. 4: 568 (1816).

Protea nitens Thunb., Fl. Cap. ed.1 (3): 514 (1813). Type: Cape of Good Hope, *Thunberg s.n.* Sheet 2944 in herb. Thunberg (UPS!).

Mimetes ? nitens (Thunb.) Roem. & Schult., Syst. Veg. 3: 384 (1818); Meisn. in DC., Prodr. 14: 266 (1856); Phill. & Hutch. in Fl. Cap. 5: 645 (1912).

An erect shrub of open growth habit, usually to 2 m, occasionally up to 3.5 m, with a single main trunk up to 80 mm in diam.; branched near base; bark thin, smooth, grey. Branches erect, rather sparsely branched, 6–10 mm in diam., densely velutinous initially, tending to glabrescent later. Leaves elliptic to broadly elliptic, held at right angles to branches, 40–65 mm long, 18–36 mm wide, densely silvery-sericeous, margins sericeously ciliate; entire, apices acute, terminating in a single apical callosity, very rarely tridentate. Inflorescence broadly cylindric, 80–150 mm long, 100–120 mm

wide, not clearly differentiated from flowering shoot at anthesis, the terminal leaves reduced, oblong, silvery-pink, forming an erect to suberect coma. *Capitula* 6–9-flowered, subtending leaf flat, held at right angles to stem, flushed deep carmine to pale mauve at base but otherwise undifferentiated. *Involucral bracts* ovate-obtuse, 7–15 mm long, 5–8 mm wide, tightly clasping perianths, cartilaginous, becoming woody in fruiting stage, outer surface puberulous but margins minutely ciliate, carmine in live state; inner series narrowly oblong, 10–12 mm long, 2 mm wide, very densely sericeous. *Floral bracts* linear-oblong, acute, 8–10 mm long, 1 mm wide, very densely sericeous. *Perianth* 25–30 mm long; tube glabrous, slightly inflated; claws filiform, densely adpressed sericeous; limbs linear-acute, 10 mm long, sparsely sericeous. *Style* straight, filiform, 40–45 mm long. *Pollen presenter* linear-acute, 7–8 mm long, slightly geniculate at junction with style, stigmatic groove terminal. *Ovary* ovoid-puberulous, 2 mm long. *Hypogynous scales* linear-subulate, 2–3 mm long. *Fruits* ovoid 7–8 mm long, 5 mm wide.

There is a discrepancy between the collector's name given in the original description of *M. argenteus* and the name inscribed on the ticket accompanying the type specimen in Salisbury's herbarium. Salisbury's published account of *M. argenteus* reads: "Mr. F. Masson discovered it by rivulets near the river Zonder End", while a ticket in Salisbury's hand, attached to the type specimen in the latter's herbarium, now at Kew, reads: "by the mountain rivulets near the river Zonde Einde Niven 72". It seems that Masson's name was erroneously substituted for Niven's in the published description.

DISTRIBUTION AND HABITAT

The distribution range of *Mimetes argenteus* forms a gentle arc in the south western Cape mountains, from Verkykerskop near Sir Lowry's Pass, along the southern and south eastern slopes of the Hottentots Holland range above Grabouw and Nuweberg to Bushmans Castle at the southern end of the French Hoek Pass; thence to Aasvoelkop and Blokkop above Villiersdorp and along the south slopes of the Riviersonderend mountains from Donkerhoek in the west to Appelskraal beyond Riviersonderend at the most easterly extremity of its range.

Mountain fynbos on steep Table Mountain Sandstone slopes is the usual habitat favoured by *Mimetes argenteus*. It is an exclusively montane species occurring on mesic sites of southerly or south easterly aspect. In such situations shadows are long, precipitation generous (up to as much as 2500 mm per year at some localities) while atmospheric humidity is relatively high throughout the year. Most populations are found at middle levels; rarely in

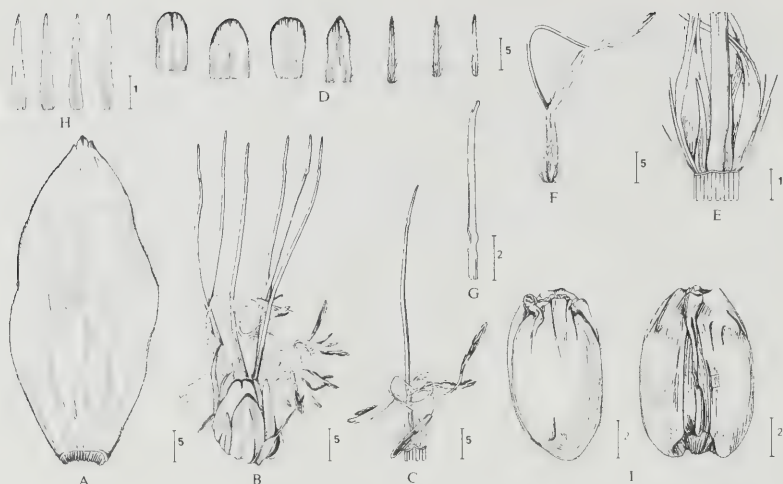


FIG. 14.

Mimetes argenteus (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) single flower prior to opening; (G) pollen presenter; (H) hypogynous scales; (I) fruits. Scale lines in millimetres. *Note:* The leaf shown here depicts the uncommon tridentate condition.

the lower foothills or on the uppermost slopes but rather within a zone lying between six hundred and one thousand metres above sea level. Occasionally scattered outliers are found at elevations up to one thousand five hundred metres, but such examples are exceptional.

Although *Mimetes argenteus* obviously favours cooler sites, it is usually found in very well-drained situations on coarse, gravelly, heavily weathered Table Mountain Sandstone in association with ericoid and restioid fynbos. Occasionally, populations occur on deeper soils where black peaty deposits, highly acid in character, have formed in seepage areas. Here again, these sites are well drained.

Mimetes argenteus has a sparse, rather open growth habit. At maturity, it is a shrub between one and a half and two metres in height, though on very moist sites it may occasionally reach three and a half metres, especially if the soil is also deeper than usual. The trunk rarely exceeds 80 mm in diameter and divides very near ground level into several upright main branches. Both trunk and main branches are slender, covered with a thin layer of smooth grey bark, quite unlike the thick juicy bark that covers the relatively massive trunk in *Mimetes arboreus*. A distinctive feature of *Mimetes argenteus* is its



FIG. 15.
Distribution of *Mimetes argenteus*.

tendency to produce long, straight, unbranched growths—sometimes as much as a metre or more in length—without developing any side branches.

At very favourable sites within the species' range, especially certain moist valleys on the south eastern slopes of the Hottentots Holland mountains, quite large stands of *Mimetes argenteus* can be seen, consisting of several hundred individuals. However, this gregarious mode of occurrence is not altogether typical, as this species is usually seen to occur in scattered groups of a dozen or more. In drier situations, especially towards the eastern extremity of its distribution range, it tends to be much rarer and even more widely dispersed.

Mimetes argenteus is a relatively short-lived species depending on cyclical burns to rejuvenate aging populations. Seedlings germinating after a fire make vigorous growth, flowering within five years. Adult plants reach their prime between ten and fifteen years. Thereafter, annual growth increments become shorter as senescence sets in. Most specimens rarely live longer than twenty-five years.

Of all silver-leaved Proteaceae in southern Africa, *Mimetes argenteus* has the most brilliantly reflective, scintillating foliage. The indumentum is particularly dense as well as being smooth and very closely adpressed. Moreover, the whole effect is heightened by the position in which the leaves are held—at right angles to the branches—resulting in maximum light reflection.

Flowering takes place between March and June. During flowering and especially for a few months thereafter, the inflorescence leaves subtending each axillary capitulum, became suffused with pinkish-mauve to carmine pigments, especially in their axils, creating a most arresting effect.

DIAGNOSTIC CHARACTERS

The only other *Mimetes* with which this species could possibly be confused is *M. arboreus*. Marked differences in growth habit easily distinguish them in the field since *M. argenteus* is a one to three and a half metre tall shrub with a loose, open, rather sparsely branched growth habit, quite unlike the dense arborescent form of *M. arboreus*. An unmistakable characteristic of *M. argenteus* is its tendency to produce straight, vigorous, unbranched shoots up to a metre long, terminating in an inflorescence, yet without forming any side branches.

However, the most obvious diagnostic character is the *elliptic to broadly elliptic*, patent leaves, produced at right angles to the branches. The perianth length is also distinctive, being from 25–30 mm in length, somewhat shorter than the 30–40 mm long perianths in *Mimetes arboreus*. It is also worth noting that the inflorescence leaves subtending each axillary capitulum, remain flat and undifferentiated during flowering, apart from becoming brightly suffused with carmine basally.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): French Hoek Peak, south slopes (-CC), June, *Esterhuysen* 27795 (BOL); Drakenstein mts., June, *van Breda* 1876 (PRE); Franch Hoek mts., towards Villiersdorp, April, *de Villiers s.n.* No. 9851 in herb. Marloth (PRE); Aasvogelkop, eastern slopes, Villiersdorp, April, *Rycroft* 2217 (NBG); Blokkop above Villiersdorp, on rocky south slopes south east side of peak (-CD), Nov., *Esterhuysen* 35103 (BOL).
—3418 (Simonstown): Moordenaars Kop (-BB), July, *Esterhuysen* 2650a (BOL, PRE); Elgin Forest Reserve, Moordenaars Kop, May, *Stehle* 37 (STE); Jonkershoek Forest Reserve, above second waterfall, Nov., *Rycroft* 1431 (NBG); Langkloofberg, Hottentots Holland mts., *Stokoe s.n.* (SAM 57378); Hottentots Holland mts., *Hallack s.n.* (PRE 28985); Hottentots Holland mts., June 1923 (figured for Flowering Plants of S.A.), *T. P. Stokoe* 2728 (PRE, K).
—3419 (Caledon): Dwarsberg, Nuweberg Forest Reserve, May, *Rourke* 1535 (NBG, MO); Nuweberg Reserve Elgin (-AA), *Stokoe s.n.* (PRE 28981); Elgin veld reserve, May, *Stokoe s.n.* (PRE 28984); Nuweberg, south slopes of Hottentots Holland, May, *Rourke* 421 (NBG); Nuweberg Forest Reserve, July, *Williams* 470 (NBG); Nuweberg Forest Reserve, source of Palmiet river, May, *Stehle* 119 (STE); Elgin Forest

Reserve, Aug., *Hubbard* 450 (STE); Donkerhoek mountains at Nootgedacht farm (-AB), May, *Rourke* 1708 (NBG); Mountains above Greyton (-BA), July, *M. Richfield* s.n. (STE); In paludosis ad Appelskraal, Riviersonderend (-BB), *Zeyher* 3688 (BOL, in herb. Meisner, NY); Oubos, Zonder end mts., April, *Stokoe* 2127 (PRE); Sonderend mts., near Riviersonderend, July, *Marloth* 13447 (PRE); Riviersonderend Mountains, Pilaarkop, May, *Kruger* 1251 (STE); Riviersonderend, March, *K. Neethling* s.n. (STE 26358).



FIG. 16.

Mimetes arboreus (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) single flower prior to opening; (G) pollen presenter; (H) hypogynous scales; (I) fruits. Scale line in millimetres.

(6) *Mimetes arboreus* Rourke in *Mimetes*: 74 (71-77) Oct. 1982. Type: Steenbras Ridge, above Somersfontein, 12 4.1982. *J. P. Rourke* 1773 (NBG, holo.!; PRE, K, MO, S, NSW, isos.!).

Icones: Veld & Flora 67 (2) 1981—front cover and title page—habitat.

Large shrub or small tree 2-6 m in height with a clean, stout, clearly differentiated trunk 100-360 mm in diam., usually branching from about 0.5-1 m above ground level; upper branches repeatedly dichotomous, forming dense rounded crown 2-5 m in diam.; bark grey with prominent horizontal striations becoming reticulately fissured at base; bark corky up to 10



FIG. 17.

Mimetes arboreus: a 20-year old specimen showing its growth habit (left) and stout main trunk (right).



FIG. 18.

Comparison between the compound inflorescences of *Mimetes argenteus* (left) and *M. arboreus* (right).

mm thick on trunk. *Branches* 10–14 mm thick, densely cinereously sericeous to villous, later glabrous; lower branches devoid of foliage, covered with prominent leaf scars. *Leaves* lanceolate-acute, sessile, ascending imbricate, 50–82 mm long, 8–33 mm wide, densely silvery-sericeous, entire with a single dark reddish-amber apical callus (only very rarely tridentate). *Inflorescence* broadly cylindric 80–100 mm wide, topped by a flattened coma of reduced, pink-flushed, lanceolate-acute leaves. *Capitula* 8–13-flowered; subtended by a subascending somewhat cucullate leaf, flushed pinkish-orange during anthesis. *Outer involucrel bracts* equal, oblong to oval, obtuse to rounded, 10–18 mm long, 5–7 mm wide, cartilaginous, woody when dry, densely sericeous, margins fimbriate; inner series becoming oblong to narrowly oblong, 10–20 mm long, 2–3 mm wide, hirsute. *Floral bracts* linear, 15 mm long, 1–2 mm wide, densely hirsute. *Perianth* 30–40 mm long, straight, usually pink but occasionally pale yellow; tube 3 mm long, quadrangular proximally, inflated distally, glabrous; claws filiform, sericeous to densely sericeous; limbs linear-cymbiform, acute, sericeous, 10 mm long. *Anthers* sessile, linear-filiform, apical boss acute. *Style* straight, filiform, glabrous, 45–55 mm long. *Pollen presenter* linear-filiform, 7–8 mm long, geniculate at junction with style, apex acute, slightly curved, stigmatic groove terminal. *Ovary* ovoid, 2 mm long, densely adpressed sericeous. *Hypogynous scales* linear-subulate, 2 mm long. *Fruits* ovoid, 10 mm long, 5 mm wide.

The earliest herbarium record of *M. arboreus* is a specimen collected by Stokoe labelled "Hangklip mountains 1921". Like most subsequent collections of this arborescent lanceolate-leafed silver *Mimetes* from the Kogelberg State Forest, Stokoe's original material was erroneously identified as *M. integrus* Hutch., a name now reduced to synonymy under *M. splendidus* Salisb. ex Knight. In a few instances other collections were tentatively determined as *M. argenteus* Salisb. ex Knight but in most cases local herbaria persisted in using the name *M. integrus* Hutch. for the Kogelberg taxon. This was perhaps only to be expected as it was clearly not the same as *M. argenteus* Salisb. ex Knight but matched most closely the *Flora Capensis* description of *M. integrus* Hutch. However, *M. integrus* Hutch. is conspecific with *M. splendidus* Salisb. ex Knight and consequently the Kogelberg *Mimetes*, being without a name, has been newly described as *Mimetes arboreus* Rourke. A good colour photograph of *Mimetes arboreus*, in its natural habitat, was featured on the front cover of *Veld & Flora* Vol. 67 (2), June 1981.

DISTRIBUTION AND HABITAT

Mimetes arboreus is endemic to a very restricted area south-east of Cape Town, comprising the Kogelberg State Forest Reserve and immediately

adjacent mountains. Occasional populations are dispersed throughout this reserve from Steenbras Ridge and the eastern foothills of Kogelberg Peak above Somersfontein, to the Dwars River mountains and Kuduberg. The most southerly populations are found above Betty's Bay on Pringle Peak, Voorberg and Platberg.

Geographically, *M. arboreus* and *M. argenteus* are mutually exclusive. There is no overlap in their distribution ranges. A low gap in the Hottentots Holland mountains of approximately twenty-two kilometres, centred around Sir Lowry's Pass, separates the most southerly populations of *M. argenteus* on Verkykerskop from the most northerly populations of *M. arboreus* on Steenbras Ridge and the eastern foothills of Kogelberg above Somersfontein.

Mimetes arboreus is an uncommon species; indeed it may be more accurate to describe it as rare, for at any given time there are probably scarcely more than a thousand living individuals within its entire distribution range. Usually tending to be solitary, this species is most frequently observed as a single isolated specimen in mountain fynbos. Small groups of up to a dozen widely scattered individuals are less often encountered, while a large stand, consisting of anything up to a hundred trees, has only been observed at one locality, namely, in the eastern foothills of Kogelberg.

Its habitat is deeply incised mountainous country adjacent to the sea. Steep upper Table Mountain Sandstone slopes at elevations between 450 and 1 200 m, are typical of the terrain. Most populations are found where the aspect is southerly or south easterly, resulting in a cooler microclimate; but despite this obvious preference, *M. arboreus* is occasionally seen on drier and warmer, westerly or northerly slopes. Everywhere within its range the moderating influence of the sea is significant. There are no populations further than twelve kilometres from the coast

Mimetes arboreus is a slow growing relatively long-lived species. A population regenerating after fire has been under intermittent observation by the author since 1963. In 1963 the young seedlings were estimated to be two years old. Their average height was 0,3 m. First flowering in some of these specimens occurred in their fourteenth year, while in others the first flowering was only recorded in their sixteenth year. By their twentieth year they had attained an average height of 2,5 m. Only three or four inflorescences are produced in the first flowering season but on old mature specimens up to 150 inflorescences have been counted.

The largest tree examined by the author, on Voorberg above Betty's Bay, in 1980, measured 6 m in height. This particular tree has a massive trunk 360 mm in diam., branching at 1 m from the ground into four stout arms supporting a broad crown 4 m in diam. Estimating the age of such a tree is difficult but knowing that accurately aged twenty-year old specimens

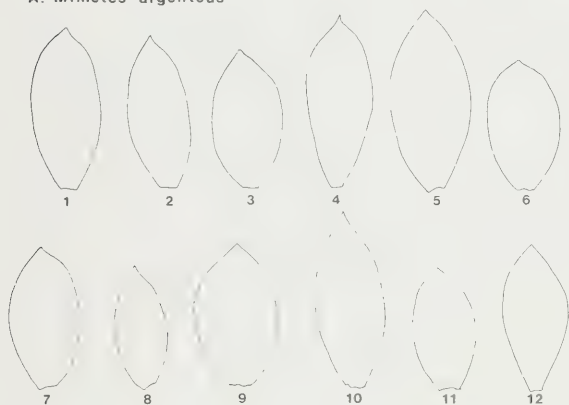
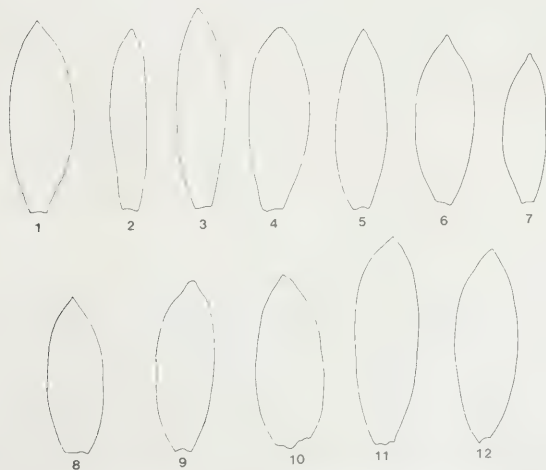
A. *Mimetes argenteus*B. *Mimetes arboreus*

FIG. 19.

Leaf outlines showing differences in form between *Mimetes argenteus* Salisb. ex Knight (A) and *Mimetes arboreus* Rourke (B). The outlines have been traced from collections in STE, NBG and SAM. (A) *M. argenteus*: (1) Rourke 421; (2) Williams 470; (3) Rycroft 1431; (4) Rycroft 2217; (5) Loos STE 104643; (6) Kruger 1251; (7) Stokoe SAM 57378; (8) Richfield s.n. in STE; (9) Stehle 119; (10) Hubbard 450; (11) Stehle 37 (12) Neethling STE 26358. (B) *M. arboreus* (1) Rourke 1478; (2) Rourke 1551; (3) Rourke 2; (4) Esterhuysen 31540; (5) Ackerman SAM 69115; (6) Rycroft 1446; (7) Ackerman NBG 104638; (8) Kruger 1382; (9) Boucher 1324; (10) Boucher 1261; (11) Boucher 190; (12) Powrie 1.

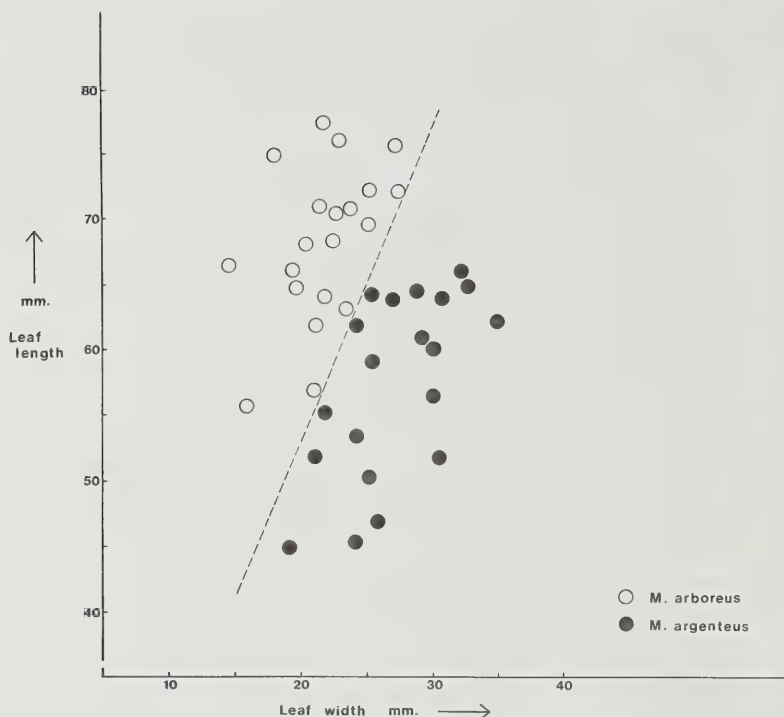


FIG. 20.

Scatter diagram of leaf length plotted against leaf width in *Mimetes argenteus* (black circles) and *Mimetes arboreus* (open circles). Representative leaves from twenty collections of each species in BOL, PRE, NBG, SAM and STE were used to prepare the diagram. No clear-cut separation between the two taxa can be made on the basis of leaf dimensions but it is evident that the leaves of *M. arboreus* are perceptibly longer and narrower than the leaves of *M. argenteus*.

are 2,5 m tall on average, it seems likely that a 6 m tall specimen would be at least fifty years old, if not more. Significantly, large specimens as described above, still appear to be growing vigorously, showing no signs of senescence.

It is evident that *M. arboreus* is slow in reaching sexual maturity as well as being unusually long-lived; factors which must be taken into account in veld management programmes.

Under certain circumstances this species is able to survive burning. Two specimens examined on Kuduberg were found to have survived a light burn. Although most of the lower branches had been destroyed, shoot regener-

ation from buds, on the uppermost branches, was taking place. However, such instances of survival after a veld fire must be regarded as exceptional despite the relatively thick bark protecting the trunk and branches.

Flowering takes place from April until June. The fruits mature and are released in late December and January.

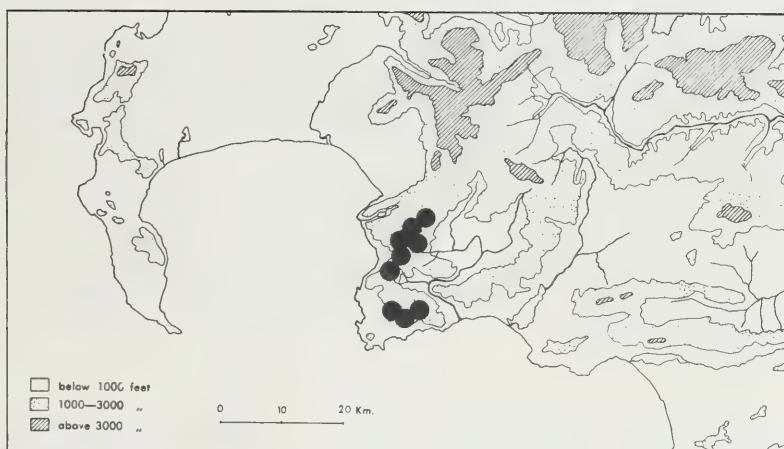


FIG. 21.
Distribution of *Mimetes arboreus*.

DIAGNOSTIC CHARACTERS

Mimetes arboreus is immediately distinguished from *M. argenteus* by its arborescent growth habit. The massive trunk 100–360 mm in diam., covered with 5–10 mm thick bark and the densely rounded crown of short, repeatedly dichotomous branches are particularly characteristic of this species. At anthesis the leaves subtending each axillary capitulum are distinctly cucullate and flushed pinkish-orange (“salmon pink”), unlike the flat, patent, mauvy-carmine subtending leaves in *M. argenteus* (Figs 17 and 18).

It is further distinguished by its ascending-imbricate lanceolate leaves. (In *M. argenteus* the leaves are ovate to broadly elliptic). No sharp distinction can be made between *M. arboreus* and *M. argenteus* based on leaf dimensions, but it is clear from the scatter diagram (in Fig. 20) that the leaves of *M. arboreus* are markedly longer and narrower than those of *M. argenteus*. Leaf outlines from collections throughout both species (Figs 19) also indicate these differences.

SPECIMENS EXAMINED

CAPE PROVINCE—3418 (Simonstown): Kogelberg State Forest, Spinnekopsnes (-BB), July, *Kruger 1382* (STE); Kogelberg Peak, in a kloof on N E side of summit, April, *Rourke 1481* (NBG, MO); Steenbras Ridge, above Somersfontein, April, *Rourke 1773* (NBG, PRE, K, MO, S, NSW); Ridge east of Spinnekopsnes kloof, May, *Powrie 1* (STE); Ridge east of Spinnekopsnes kloof, May, *Esterhuysen 31535* (BOL); Kogelberg, Spinnekopsnes Range, July, *Boucher 1324* (STE); Northern extremity of Spinnekopsnes Range, south east aspect near Boegoe kloof, May, *Boucher 1261* (STE); Kogelberg Ridge, south side of peak towards Rooiels, May, *Esterhuysen 31540* (NBG); Kogelberg, July, *Ackerman s.n.* (SAM 69115); Kogelberg Forest Reserve, Nov., *Rycroft 1446* (NBG); Kogelberg, June, *Ackerman s.n.* (NBG 104638); Hangklip mountains (-BD), *Stokoe s.n.* (SAM 16902); Pringle Peak, south east slope below summit, July, *Rourke 2* (NBG); Voorberg, Betty's Bay, May, *Rourke 1551* (NBG); Platberg, Kogelberg Forest Reserve, Dec., *Boucher 190* (STE).

- ✓ (7) *Mimetes hottentoticus* Phill. & Hutch. in Flower Pl. S. Afr. 3: t. 82 (1923); Everard & Morley, Wild Flowers of the World: 75 (1970); Veld & Flora 61 (1): habitat photo on cover (1975); Rourke in *Mimetes*: 81–87 (1982). Type: Hottentots Holland mountains south east of Kogelberg, Jan. 1922, *T. P. Stokoe s.n.* PRE 1641 (holotype, PRE!; K!, isotype; BM, isotype!).

An erect shrub of variable growth habit ranging from slender and sparsely branched to rounded and well branched, 1.5–2 m, occasionally 3 m tall, up to 2 m in diam., with upright branches developing from a single stout main trunk up to 100 mm in diam. Branches 5–8 mm in diam., cinereously villous, lowermost branches glabrous, devoid of foliage. Leaves sessile, ascending to subimbricate, oval to broadly oval 50–75 mm long, 28–40 mm wide, very densely silvery-sericeous, margins villous, apices obtusely tridentate, only very occasionally entire. Inflorescence broadly cylindric, 70–140 mm long, 70–120 mm wide, topped by an erect coma of reduced oblong to narrowly oblong leaves, silvery but occasionally pink-flushed. Capitula 8–12-flowered, subtended by a flat undifferentiated leaf, remaining silvery during anthesis. Outer involucre bracts lanceolate-acuminate 15–22 mm long, 2–5 mm wide, cinereously villous; inner series becoming narrowly lanceolate-acuminate. Floral bracts linear-subulate, very densely villous, 12–16 mm long, 1 mm wide. Perianth 35–38 mm long; tube quadrangular, 4–5 mm long, glabrous; claws filiform, densely villous; limbs lanceolate-acute, 5–7 mm long, villous. Anthers sessile, oblong-obtuse, apical connective usually minutely bilobed. Style 65–70 mm long. Pollen presenter black, broadly obconic-capitate, with an acute apical papilla containing the stigmatic groove; quadrangularly grooved basally. Ovary 3–4 mm long, scarcely differentiated from style; minutely sericeous. Hypogynous scales linear-subulate, 2–3 mm long. Fruits a broadly ovoid achene 8 mm long.

DISTRIBUTION AND HABITAT

Mimetes hottentoticus is confined to an area of little more than five square kilometres in the Kogelberg Forest Reserve, about seventy-five kilometres south east of Cape Town. The largest population is found on the upper south east slopes of Kogelberg Peak, extending to the head of Spinnekopsneskloof. Smaller, isolated groups occur nearby at the north western end of the Dwars River mountains (also known as Groenlandberg on some maps), as well as on the south east slopes of Kudu Peak, a prominent eminence situated immediately adjacent to Kogelberg. Not only is its spatial distribution very localised, its altitudinal range is equally compressed, being limited to a zone between 1 000 and 1 260 m.

The whole habitat enjoys permanently damp soil. Other moisture lovers like *Chondropetalum mucronatum*, *Brunia alopecuroides* and *Erica desmantha*, are important associated species contributing to the rank surrounding plant cover. Moisture is precipitated throughout the year, mainly from winter north westerlies, but also from cloud banks brought in by the south easterlies of summer.

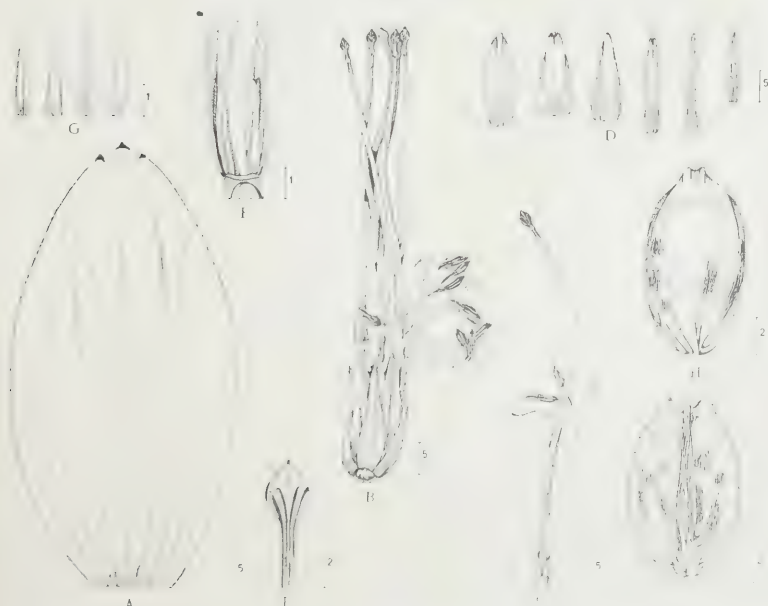


FIG. 22.

Mimetes hottentoticus (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) pollen presenter; (G) hypogynous scales; (H) fruits. Scale lines in millimetres.



FIG. 23.
Distribution of *Mimetes hottentoticus*.

Like most proteaceous shrubs in fynbos, *M. hottentoticus* is relatively short-lived. Its life span probably rarely exceeds thirty years. At maturity it is a robust shrub two or three metres in height, rounded and moderately well-branched. However, as senescence sets in a less bushy growth habit is developed. Lateral branches are shed, while leaves are also shed from all but the ultimate and penultimate growth flushes. By about twenty years of age most specimens look distinctly moribund with only one or two leader branches, causing elderly specimens to have a sparse leggy appearance. With the advent of a veld fire, practically all adult plants are killed, but in a few rare instances, where the fire is not too severe, an old adult may survive burning, though such cases are seldom encountered. During the first decade, after a fire, great numbers of robust young plants are observed, but as aging takes its natural toll, a steady decline in numbers is apparent. Ultimately, in old veld unburnt for many years, only a few individuals will be found.

Cyclical fluctuations in population size are therefore an important characteristic of this, as well as many other species. These fluctuations can frequently be related to the length of the intervals between fires. At optimum levels of the cycle there may possibly be as many as one thousand five hundred robust specimens of *M. hottentoticus*, while at low points, numbers may drop to one hundred or even fewer moribund individuals. Fire is an essential regenerator in fynbos, yet its periodicity and timing requires critical control to ensure the species' survival.

Flowering commences during the last week of January, reaching a peak in February, continuing into March. Odd specimens may even persist until

as late as May, though this is very unusual. The fruits take at least nine months to mature, with the first ripe fruits being shed in late November and early December. They are exceptionally large (on average 8 mm long) and are presently the largest of all *Mimetes* fruits, though it is probable that *M. stokoei* (now extinct) had fruits of comparable dimensions

DIAGNOSTIC CHARACTERS

Mimetes hottentoticus could never be confused with any other species in the genus. It is clearly allied to *Mimetes stokoei* but is easily distinguished from that species by its lanceolate-acuminate involucre bracts and bushy, well-branched growth habit.

SPECIMENS EXAMINED

CAPE PROVINCE—3418 (Simonstown): Steenbras River Valley (-BB), Nov. 1921, *Stokoe s.n.* (BOL); Hottentots Holland mountains, March 1922, *Stokoe s.n.* (BOL 15221); Hill adjoining and east of Kogelberg, landward side, 1921, *Stokoe s.n.* (BOL); Hottentots Holland mountains, Feb. 1922, *Stokoe s.n.*—with colour sketch (BOL 15221); Steenbras River Valley, 19 March 1923, *Stokoe s.n.* (BOL 17375); Kogelberg, May 1939, *Stokoe s.n.* (BOL); Kogelberg State Forest, Spinnepokopsnes, Feb., *Kruger 1582* (STE); Kogelberg Forest Reserve, spur at northern extreme of Dwaars River mountains overlooking Steenbras dam, Feb., *Boucher 1806* (STE); Kogelberg Peak, April, *Boucher 1250* (STE); Kogelberg, Jan., *Macpherson s.n.* (NBG 104650); Kogelberg Forest Reserve, Nov. (fruiting), *Rycroft 1442* (NBG); Kogelberg, south east slopes below summit, Feb., *Rourke 257* (NBG); East of Kogelberg at summit of the peak at north end of Five Beacon Ridge, March, *Rourke 1185* (NBG); Kogelberg, June, *Ackermann s.n.* (NBG 104652); Mountains near Kogelberg, east of Steenbras River, Feb. 1922, *Stokoe s.n. 11059* in herb. Marloth (PRE); Hottentots Holland mountains south east of Kogelberg, Jan. 1922, *Stokoe s.n.* (PRE 1641), painted by Miss Lansdell for Flowering Plants of S.A. (PRE, K, BM); Kogelberg Peak, east slopes below summit, March, *Rourke 1477* (NBG, MO).

- ✓ (8) *Mimetes stokoei* Phill. in Kew Bull. 1922: 198 (1922); Phill. in Flower Pl. S. Afr. 23 t. 916 (1943); *Stokoe* in Jnl. of Mountain Club of S.A. 54: 61–63 (1951); Jarvis in Cape Wild Life 13: 6–7 (March 1958); Rourke in Veld & Flora 62 (4): 12–16 (1976); Rourke in *Mimetes*: 91–99 (1982). Type: Hottentots Holland mountains south east of Kogelberg, Feb. 1922, *T. P. Stokoe s.n.* (PRE 1642, holotype!; K, isotype!).

A slender, erect, columnar shrub of monopodial growth habit, 1–2 m in height, usually unbranched but occasionally producing between one and three side branches from upper part of the single main stem at maturity; main stem to 25 mm in diam. at base. Branches villous, 5–8 mm in diam. Leaves ascending, subimbricate, ovate to broadly ovate-acute, 50–80 mm long, 25–40 mm broad, sessile to subcordate at base, apex acute, tridentate, the central tooth longer and more prominent than the two laterals; densely silvery-sericeous. Inflorescence broadly cylindric, 100–150 mm long, topped

by a flattened coma of reduced, horizontally patent leaves, having a pinkish-purple hue in live state. *Capitula* 8–12-flowered, subtended by a prominently cucullate leaf; subtending leaves flushed yellowish-gold with a faint pinkish-purple overlay during anthesis. *Outer involucrel bracts* oval to rounded, 10–16 mm long, 8–15 mm broad; inner series becoming oblong to linear-obtuse, 15–20 mm long, 3–8 mm broad; sparsely sericeous on outer surface, margins densely sericeously ciliate. *Floral bracts* linear to linear-spathulate, obtuse, 15–18 mm long, 2–3 mm broad, densely tomentose. *Perianth* 35–45 mm long; tube quadrangular, 5 mm long, glabrous but becoming villous distally; claws linear-filiform, densely villous; limbs linear-filiform, acute, scarcely differentiated from claws, 6–8 mm long, villous. *Anthers* sessile, with a broadly saggitate to spade-shaped, black apical connective. *Style* 50–65 mm long. *Pollen presenter* narrowly obconic with an acute apical papilla containing the stigmatic groove, tapering proximally to a distinct annulate junction with style. *Ovary* 1–2 mm long, scarcely differentiated from style. *Hypogynous scales* linear-acute, 3 mm long.

DISTRIBUTION AND HABITAT

Mimetes stokoei was recorded from a single site on Paardeberg in the Highlands Forest Reserve above Kleinmond in the south western Cape. Two small groups consisting of up to a dozen plants, separated by a few hundred metres, occurred between 560 and 600 m above sea level at this site. This species has not been observed or collected at any other locality despite intensive searches in the Kogelberg and Highlands Forest Reserves during the past half century. The type locality is a gently sloping valley with a substratum of light, well-drained Table Mountain Sandstone derived soil, moist in winter but dry in summer. Since 1967 no living plants of *M. stokoei* have been observed and consequently it is now regarded as extinct (Rourke, 1979).

At no time in the recorded history of *M. stokoei*, between 1922 and 1967, did either of these two groups in the field ever exceed much more than about a dozen living plants. The paradox of this species is that although it occupied a near virgin habitat where human influence can be regarded as minimal, it apparently drifted into extinction through natural causes rather than man-induced pressures.

DIAGNOSTIC CHARACTERS

Numerous characters distinguish *Mimetes stokoei* from related taxa; in particular, the largely unbranched monopodial growth habit, the silvery ovate leaves having prominently acute tridentate apices with a central tooth



FIG. 24.

Mimetes stokoei (A) mature leaf; (B) immature leaf; (C) axillary capitulum; (D) involucral bracts; (E) single flower; (F) base of perianth; (G) pollen presenter; (H) hypogynous scales. Scale lines in millimetres.

that is longer and more prominent than the two laterals; but most particularly by the rounded to oval involucral bracts.

POSSIBLE REASONS FOR EXTINCTION

1. *Population Size*

The historical evidence points to a critically small population size in *M. stokoei* during this century. Although no accurate figures are available, rough counts of population numbers reported at various times between 1922 and 1967, indicate that no more than about a dozen live plants were counted at any given time (Rourke, 1979). At this stage there is no consensus as to the minimum number of living individuals necessary to maintain an evolutionarily viable population, but Franklin's calculation reported in Frankel and Soulé (1981), that a minimum effective population size of 500 is needed to preserve useful genetic variation, has been given cautious support in some quarters. Even allowing for gross errors in establishing population numbers

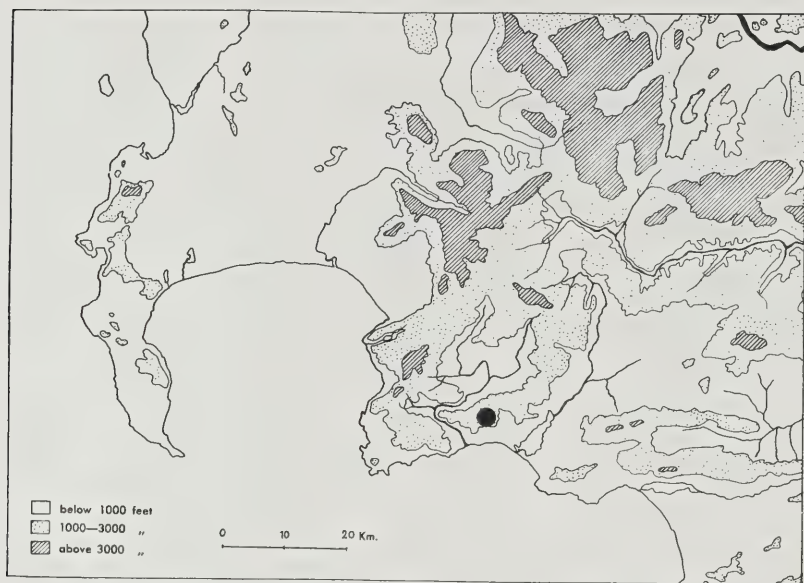


FIG. 25
Distribution of *Mimetes stokoei*.

in *M. stokoei*, the available figures are so far below Franklin's number that it seems clear that population numbers had already dropped to irrecoverably low levels by the time of the species' discovery.

2. Erratic flowering

Historical records and also collecting dates on the few extant herbarium specimens, indicate that flowering was recorded in January, February, May, June, July and November. Despite the statistical inadequacy of this record, an erratic flowering pattern is indicated with apparently little synchronisation of flowering.

In very small populations, erratic flowering would have drastically reduced the chances of cross-pollination taking place and consequently annual seed set must be presumed to have been very low.

3. Growth Pattern and Regeneration Cycle

An examination of all existing photographs showing *M. stokoei* in its



FIG. 26.

Mimetes stokoei. Schematic representation of the life cycle of this species, showing its monopodial mode of growth from seedling through flowering stages, to senescence. Nine years of growth are depicted with death occurring in the tenth year. Note the differences in length of the annual growth increments as the plant develops and ages. Flowering axillary capitula are hatched. The abscission scars of the previous years' axillary capitula are also indicated. Apical meristems are indicated with an arrow.

natural habitat indicate that it was characterised by a highly reduced, monopodial growth habit. Coupled with the very early onset of senescence, this mode of growth gave rise to a naturally short, abbreviated life cycle. It appears that the life-span of this species rarely exceeded ten years. *Mimetes stokoei* apparently attained a maximum height of about two metres. Each plant consisted of a single columnar succession of annual growth flushes. Only occasionally was one, two, or at most, three, unbranched side shoots produced. Flowering appears to have commenced from about the third or fourth year from seed. Growth was more vigorous from about three to seven years of age, at which time the growth increments were sometimes as much

as 400 mm in a single year. However, from about the sixth year the annual growth increments shortened as senescence set in (Fig. 26).

Seeds falling to the ground during this brief reproductive phase would have been gathered up by ants and buried to form a seed store in the soil (Slingsby & Bond, 1981), only germinating in response to the stimulus of a veld fire. As seed viability diminishes with age, the longer the period of protection from burning after a population senesces the fewer the regenerating seedlings will be. The occurrence of a fire a few years after the majority of plants in a population had died of senescence, would probably have resulted in a fairly high percentage germination. It is known that a single seedling of *M. stokoei* germinated on Paardeberg fifteen years after the last adults had died, in response to the first fire in the area during that period. (Rourke, 1979). Had a fire occurred earlier, a higher germination rate might have been expected. Prolonged protection of the veld from burning—for periods of twenty years or more—may have been too long a break in the short regeneration cycle of this species to permit adequate seedling regeneration.

The reasons for the decline and extinction of *M. stokoei* will always be speculative but it is possible that the factors described above played significant contributory roles.

SPECIMENS EXAMINED

CAPE PROVINCE—3419 (Caledon): Hottentots Holland mountains, south east of Kogelberg (-AC), Feb. 1922, *T. P. Stokoe s.n. sub. PRE 1642 (PRE, K)*; Palmiet River Mountains, Paardeberg, near Kleinmond, June 1943, *T. P. Stokoe s.n. sub. SAM 54954 (SAM)*; Top of Paardeberg, Sept. 1950, *T. P. Stokoe s.n. sub. SAM 60998 (SAM, PRE)*; Hottentots Holland mountains, July 1925, *T. P. Stokoe s.n. No. 6548 in herb. Marloth (PRE)*; Hottentots Holland mountains (bought in Adderley St., Cape Town, July 4th), comm. *T. P. Stokoe s.n. (BOL, PRE)*; Top of Paardeberg, Sept. 1950, *T. P. Stokoe s.n. (SAM 60998)*—not flowering; Near Hangklip on the Hottentots Holland mountains, figured for Flowering Plants of S.A., June 1943, *T. P. Stokoe s.n. PRE 27141 (= SAM 54954)*; Palmiet Berg, Vogts plot, 12/9/1969, *C. Boucher 630 (STE)*.

- ✓ (9) *Mimetes hirtus* (L.) Salisb. ex Knight in Knight, Cult. Prot.: 66 (1809); R. Br. in Trans. Linn. Soc. Lond. **10**: 105 (1810); Reichenb., Ic. Bot. Exot.: 62 t 92 (1827); Meisn. in DC., Prodr. **14**: 262 (1856); Phill. & Stapf in Fl. Cap. **5**: 648 (1912); Bolus, Barclay and Steer, A First Book of S.A. Flowers: 84, 85 (1928); Adamson & Salter, Fl. of Cape Penins.: 327 (1950); Rousseau, Proteaceae of S.A.: 61 (1970); Rourke in Mimetes: 103–109 (1982).

Leucadendron hirtum L., Plant. Rar. Afr.: 8 (Dec. 1760); Sp. pl. ed 2: 136 (1762). Type: C.B.S. without collector or precise locality, sheet 116.36 in herb Linn. (LINN, lecto!).

Protea hirta (L.) L., Mant. Alt.: 188 (1771); Thunb., Diss Prot.: 43 & 57 (1781).

PRE-LINNAEAN CITATIONS

Lepidocarpodendron; foliis sericeis brevibus confertissime natis; fructu gracili longo. Boerhaave, *Index Alter Plant.* 2: 194 t. 194 (1720).

Fruticosa afr. aquat. spina fl. rubro. No date or author. Folio 23, *Index Plant et Animal in Africana Mus.*, Jhb.

An erect well-branched shrub 1–2.5 m in height with a single main trunk up to 75 mm in diam.; bark smooth and reddish. *Branches* stiffly upright, very densely villous to lanate initially but soon becoming glabrous, 5–8 mm in diam. *Leaves* ascending imbricate, lanceolate to broadly lanceolate, entire, 25–45 mm long, 5–18 mm wide, apex acute with a single callus point; softly and sparsely villous at first, margins villously ciliate, later becoming glabrous. *Inflorescence* broadly cylindric, 80–140 mm long, 80–90 mm wide, topped by a flattened coma of reduced pink-flushed leaves. *Capitula* 9–14-flowered, subtended by a flat green undifferentiated foliage leaf. *Outer involucral bracts* lanceolate-acuminate, 15–40 mm long, 5–12 mm wide, papyraceous, clasping the perianths, occasionally sparsely sericeous but usually glabrous; apical margins sericeously ciliate; inner involucral bracts narrowly lanceolate-acuminate, subfalcately curved, thinly papyraceous, 20–40 mm long, 4–6 mm wide, margins sparsely sericeous. *Floral bracts* linear-subulate, 5–8 mm long, 1 mm wide, glabrous but margins minutely ciliate. *Perianth* 30–40 mm long, straight; tube quadrangularly inflated, glabrous, 5 mm long; claws filiform, sparsely puberulous proximally becoming sericeous distally; limbs linear-cymbiform, acute, scarcely differentiated from claws, sericeous. *Anthers* sessile. *Style* 50–55 mm long, slightly abaxially curved. *Pollen presenter* 4 mm long, linear-subulate terminally with a terminal stigmatic groove, prominently annulate proximally at junction with style. *Ovary* ovoid, minutely puberulous, 2 mm long. *Hypogynous scales* oblong, obtuse, carnosae, 2 mm long. *Fruits* cylindric-oblong, 6–7 mm long, 1.5–2 mm wide.

By the time Linnaeus had published his original description of *Leucadendron hirtum* in 1760, this species would have been known to him not only from Boerhaave's account and illustration which he cited, but also from a specimen labelled "*hirtum*" which must by then have been in his possession and is now in the Linnaean Herbarium (LINN) in London. It is probable that Linnaeus acquired this specimen either in 1758 or 1759 in one or other of two consignments of plants he received from N. L. Burman, who in turn would have obtained the original material from the Cape. This specimen (sheet 116.36 in LINN) is accordingly here designated as the lectotype of *Leucadendron hirtum* L.

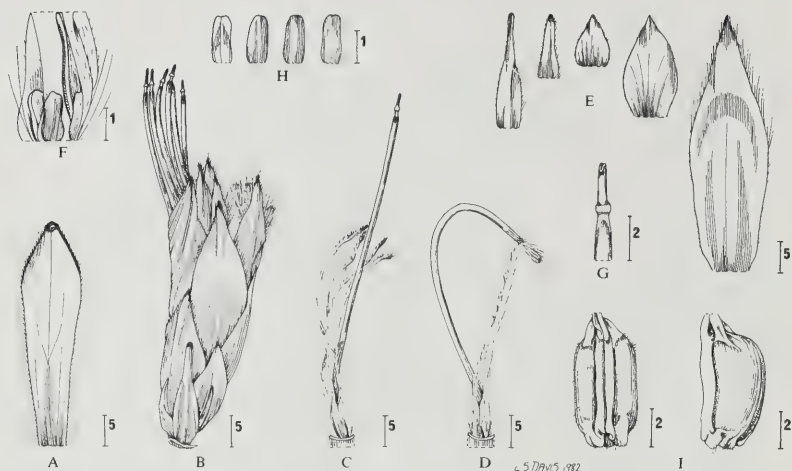


FIG. 27.

Mimetes hirtus (A) leaf; (B) axillary capitulum; (C) single flower; (D) single flower prior to opening; (E) involucral bracts; (F) base of perianth; (G) pollen presenter; (H) hypogynous scales; (I) fruits. Scale lines in millimetres.

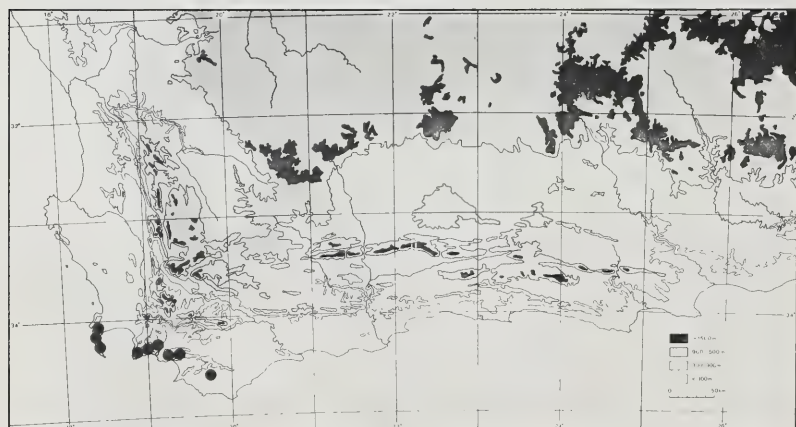


FIG. 28.

Distribution of *Mimetes hirtus*.

DISTRIBUTION AND HABITAT

Mimetes hirtus is endemic to the south western Cape coastal belt from the Cape Peninsula eastwards to Hangklip, Betty's Bay, Kleinmond, Highlands, Bot River and Hermanus, with southerly outliers in the hills around Elim. Its present-day range on the Cape Peninsula extends from Buffel's Bay in the Cape of Good Hope Nature Reserve, northwards to Silvermine reservoir; but in the past, populations were found as far north as Rondebosch.

This is one of the few mainly lowland species in the genus. Practically all known populations are found at elevations between 30 and 50 m above sea level. However, there are a few occurrences at higher levels, such as those at Silvermine and Highlands, where the elevation is some 400 m. These populations are exceptional and represent the uppermost altitudinal outliers.

Mimetes hirtus is essentially a swamp or marsh dweller, usually growing in dense local stands consisting of several hundred individuals. Sometimes populations occur on streambanks but the most typical habitat is in the densely vegetated fynbos communities that occur on rather level, permanently wet, marshy sites, a kilometre or two from the sea. Such plant communities have been termed Erica—Osmitopsis Seepage Fynbos (Boucher, 1978). These specialised associations develop at numerous places along the south western Cape Coast, especially where folded Table Mountain Sandstone peaks rise steeply from the sea but are separated from the shore-line by a narrow coastal shelf or raised beach. Moisture percolating through the high adjacent mountains oozes to the surface in seepage zones along these coastal shelves where deep, black, peaty soils, highly acid in character and sponge-like in texture, have been developed over long periods of time. It is on these seepage zones that *Mimetes hirtus* grows in association with other marsh species like *Erica persicua*, *Osmitopsis asteriscoides* and *Psoralea aphylla*.

Like most other woody plants in fynbos swamp communities, *M. hirtus* grows rapidly but is short-lived. After germinating, seedlings grow with astonishing vigour, often flowering in their second year. At about five to ten years of age they have usually reached their peak, growing robustly and flowering profusely. But soon the growth rate diminishes as senescence sets in round about the plants' fifteenth year, by which time a maximum height of a little over two metres may have been attained.

Mimetes hirtus is a winter-blooming species which reaches the peak of its flowering period in July and August, although occasionally early flowering specimens can be found in May and June, while late flowering often persists well into November.

DIAGNOSTIC CHARACTERS

Among those *Mimetes* with enlarged red and yellow involucre bracts, axillary capitula containing more than five flowers, entire leaves and linear-subulate styles, *M. hirtus* is readily distinguished by its long styles which are generally 50 to 55 mm in length.

SPECIMENS EXAMINED

CAPE PROVINCE—3318 (Cape Town): In clivis orientabilibus montis Tabularis supra Klaassenbosch (-CD), Aug. 1884, *Bodkin 4929 B* (BOL, K).

—3418 (Simonstown): Wynberg (-AB), Jan., *Roxburgh 36* (K); Rondebosch, Sept., *Mrs. Hugh Jameson s.n.* (K); Garslandskloof, Cape of Good Hope Nature Reserve, Aug., *H. C. Taylor 6885* (STE); Klaasjagers, Sept., *Garabedian s.n.* (PRE)✓ Brightwater, Cape of Good Hope Nature Reserve (-AD), March, *H. C. Taylor 7671* (STE); Smitswinkel, July, *Compton 13316* (NBG, PRE)✓ In ericitis Smitswinkel Bay, May, *Bolus 4928* (BOL); Patrys Vlei, Aug., *Wolley-Dod 1436* (BOL); In arenoso rupetribus pone promontorium Cape Point, Sept. 1888, *MacOwan 911* (BOL, K, SAM); In turfaceis ad rivulus prope Uitershoeck, Cap., Sept. 1838, *Krauss s.n.* (NBG); Smitswinkel, Aug., *Barker 736* (NBG); Betty's Bay, flats south of old gaol (-BD), Jan., *Boucher 1097* (STE); Sunny Seas, Betty's Bay, Aug., *Boucher 1866* (STE); Marsh behind Hangklip mountain, April, *Stokoe 406* (STE); Sunny Seas, March, *Vogts 20* (PRE, NBG)✓ Betty's Bay, Sept., *Richmond 36* (NBG); Swamps near Cape Hangklip, March, *Andreae 879* (PRE); Between Pringle Bay and Betty's Bay in a marsh on the SE tributary of the Buffels River, below Voorberg, June, *Rourke 1643* (NBG, MO); Highlands Forest Reserve (-AC), Aug., *Hubbard 469* (STE, BOL); Highlands, Sept., *Hayes s.n.* (NBG 105616); Paardeberg Mtn., Aug., *Macpherson & Woods s.n.* (NBG 104646).

—3419 (Caledon): In a swamp above Pools Bay, between Voëlklip & Mossel River, Hermanus (-AD), Oct., *Rourke 1146* (NBG, STE); Hermanus, March, *van Niekerk s.n.* (STE 30215); Klein River Mtns., Oct., *Stokoe s.n.* (BOL 16756); Three miles south west of Elim (-DA), Oct., *Willaims 1449* (NBG); Elim, Dec., *Schlechter 9647*✓ (BM, K, PRE); In convallie humide prope Elim, Dec., *Bolus 8591* (K, BOL).

Doubtful locality records: —3319 (Worcester): Franshoek mts. (-CC), June 1931, *J. Brink s.n.* (STE 11476).

—3421 (Riversdale): Hills at Platteklief (Heidelberg-Swellendam) (-AA), Sept. 1911, *Muir 663* (PRE)✓

- ✓ (10) *Mimetes pauciflorus* R. Br. in Trans. Linn. Soc. Lond. **10**: 106 (1810); Meisn. in DC., Prodr. **14**: 263 (1856); Phill. & Hutch. in Fl. Cap. **5**: 648 (1912); Rousseau, Proteaceae of S.A.: 61 (1970); P. van der Merwe in Landbou Weekblad 24 Feb. 1978: 37 (1978); Rourke in *Mimetes*: 113–119 (1982). Type: Africa australis, *W. Roxburgh s.n.* (BM, lecto!).

Protea pauciflora (R. Br.) Poir., Encycl. Meth. Bot. Suppl. **4**: 568 (1816).

Mimetes rehmanni Gandoger & Schinz in Bull. Soc. Bot. Fr. **60**: 51 (1913). Type: Outeniqua Mts., Montagu Pass, *A. Rehmann 136* (Z, holo!).

An erect sparsely branched rather straggly shrub 2–4 m tall with a single main trunk to 50 mm in diam.; bark smooth, reddish. Branches erect, 6–

8 mm in diam., densely villous. *Leaves* ascending, imbricate, narrowly to broadly oval, obtuse, 25–40 mm long, 8–20 mm wide; entire with a single amber callus point at apex; surface rather sparsely adpressed villous, margins villously fimbriate. *Inflorescence* 100–400 mm long, 50–55 mm wide, cylindric, composed of approximately 40 to 120 densely arranged, upwardly pointing axillary capitula overtopping a small, terminal coma of reduced erect foliage leaves. *Capitula* 3-flowered (rarely 4-flowered), subtended by a flat, undifferentiated green foliage leaf. *Involucral bracts* lanceolate-acute, 10–25 mm long, 5–8 mm wide, fleshy, 4 to 5 in number, outermost bracts glabrous, innermost bracts pubescent at apex. *Floral bracts* 3 in number, greatly enlarged, yellow with the appearance of involucral bracts, lanceolate-acute, tightly clasping perianths to below perianth limbs, 40–55 mm long, 12–15 mm wide, glabrous proximally but becoming villous distally. *Perianth* 45–50 mm long, straight; tube 2–3 mm long, bulbous, formed by the hyaline, fleshy, outwardly bowed perianth bases, glabrous; claws filiform, covered with long, straight, spreading trichomes; limbs very narrowly lanceolate, linear, acute, 5–6 mm long, glabrous, bright red in live state. *Anthers* sessile. *Style* 45–50 mm long, tapering terminally. *Pollen presenter* 3–4 mm long, linear-filiform-acute, with a slightly annulate thickening at junction with style; stigmatic groove terminal. *Ovary* ovoid, densely puberulus, 2 mm long. *Hypogynous scales* 1 mm long, oblong-obtuse, fleshy. *Fruits* cylindric, 7 mm long, 3 mm wide.

DISTRIBUTION AND HABITAT

Mimetes pauciflorus is native to the southern Cape coastal mountains where its total east-west distribution range covers some two hundred kilometres. This species is thus rather more widespread than many of its congeners. The most westerly records are from Ruitersberg, due east of the Robinson Pass, between Mossel Bay and Oudtshoorn. From there populations are fairly evenly dispersed (though in a narrow belt, scarcely five kilometres wide), along the southern slopes of the Outeniqua and Tsitsikamma mountains to an area beyond Formosa Peak, almost reaching the Karreedouw Pass at the species' most easterly limits.

Except where there is forest in kloofs or sheltered valleys, the well-watered seaward slopes of these southern Cape coastal mountains support tall, exceptionally dense fynbos communities termed "hygrophilous macchia" (Phillips, 1931). *Erica hispidula*, *Leucadendron conicum*, *Leucadendron eucalyptifolium*, *Berzelia lanuginosa* and *Widdringtonia cupressoides*, are among the more prominent component species on the permanently moist southern slopes. It is in this dense vegetation, in montane, often steeply sloping situations, at elevations between 450 and 1 400 m, that

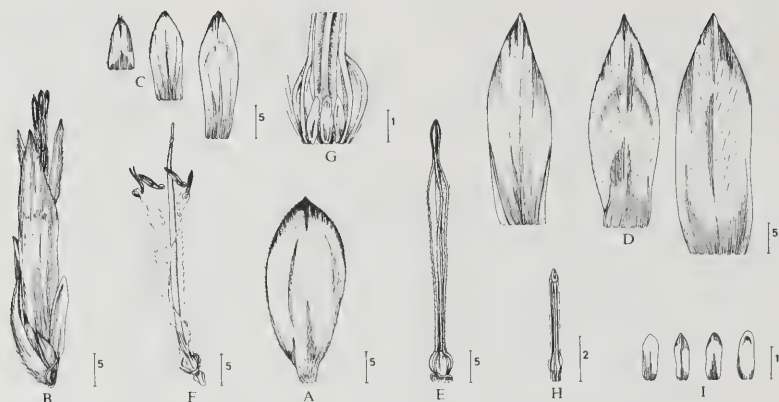
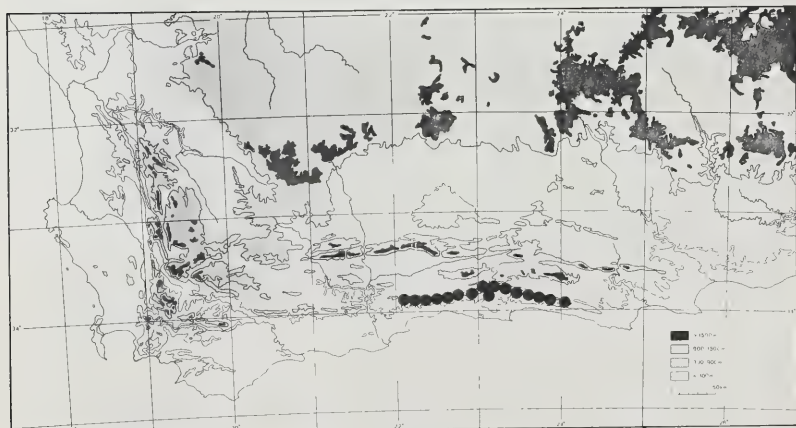


FIG. 29.

Mimetes pauciflorus (A) leaf; (B) axillary capitulum; (C) involucral bracts; (D) three floral bracts; (E) single flower prior to opening; (F) single flower on opening; (G) base of perianth; (H) pollen presenter; (I) hypogynous scales. Scale lines in millimetres.



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FIG. 30.

Distribution of *Mimetes pauciflorus*.

scattered populations of *M. pauciflorus* are found. Few other *Mimetes* are so dependent on a high, though even, water supply. Indeed, the species' entire distribution range falls within a region receiving a mean annual precipitation of at least 1 000 mm or more. The important requirement however, is not so much a high mean annual rainfall but the regularity and evenness of its distribution throughout the year.

Mimetes pauciflorus may ultimately attain a height of four metres when mature but most species seldom exceed three metres. Young plants grow rapidly and with great vigour, producing stiffly upright vegetative shoots up to half a metre long each year. As they age however, a rather sparse, open, straggly growth habit develops. Annual growth increments become shorter and leaves are shed from all but the ultimate and penultimate annual growth flushes, leaving the reddish-brown stems quite bare. Most specimens become senescent at between ten and fifteen years of age, while few survive much beyond their twentieth year.

Flowering takes place from August until November. The peak of the flowering season is in September. Robust young specimens may occasionally produce enormous inflorescences up to 400 mm long. Such outsize inflorescences are by far the most massive in the whole genus and may be composed of as many as one hundred and twenty individual axillary capitula.

An unusual feature of this species is the upward-facing position of the axillary capitula. Moreover, their involucre and floral bracts are tightly rolled around the three flowers which make up each capitulum, resulting in a tube-like structure. Each capitulum is functionally equivalent to a single tubular flower and is treated as such by pollinating sugarbirds and sunbirds, which often puncture the basal bracts with their bills to gain access to the nectar. Another characteristic is that those capitula on the northern (or warmer) side of an inflorescence develop faster and open sooner than those on the southern (or cooler) side. This differential rate of development causes partially open inflorescences to have a distinctly asymmetrical appearance; a situation not obvious in other *Mimetes*. Initially, the bracts are a rich yellow but deepen with age, eventually becoming quite orange in colour.

DIAGNOSTIC CHARACTERS

This species is distinguished by its entire oval leaves and by having only three (very rarely four) flowers in each axillary capitulum.

SPECIMENS EXAMINED

CAPE PROVINCE—3322 (Oudtshoorn); Ruitersberg, south slopes (-CC), Nov., Oliver 4114 (STE); Ruiterskop, Nov., Compton 21824 (NHU), lower slopes of Postberg (now Cradockberg) (-CD), 20/9/1814 Burchell 691 (STE), Nov., STE 117.

PRE, L); Geelhoutboomsberg, July, *Taylor 3524* (STE, PRE)[✓]; Georgetown, Aug. 1847, *Alexander Prior s.n.* (K, PRE); Lower slopes of Cradockberg, George, on a spur between Tienkloof and Power Stream, Sept., *Rourke 1489* (NBG, MO, K, PRE, S); South slopes of Wildevarkberg, Geelhoutboomsberg Forest Reserve, Nov., *Rourke 1272* (NBG); Mountains at George, Jan. 1859, *Pappe s.n.* (SAM 19854); Tienkloof, George (-DC), Nov., *W. Bond 685* (NBG); Klein Langkloof on Karatara boundary (-DD), *Vogts 80* (PRE, STE)[✓]; Spitskop, Knysna, June, *Keet 536* (STE, PRE)[✓]; Millwood, slopes south of Streepbosch creek, Sept., *Fourcade 5295* (BOL); In Montibus pone Millwood, Aug., *Tyson 1523* (K, STE, SAM); Windmeulnek, Karatara, Aug., *Vogts 704* (NBG); Upper Molen River, on ridge between Stormberg and Hoëberg, Sept., *Rourke 904* (NBG, STE); South east slopes of Hooëberg, Outeniqua Range, Oct., *Keet 1010* (PRE, STE, PH, BM)[✓]—3323 (Willowmore); Ridge above van Huysteen's Bosch, Deepwalls (-CC), July, *Keet 536* (BOL); Slightly south of summit of Jonkersberg, Gouna Forest Reserve, Aug., *E. A. Goodwin s.n.* (BOL); Buffelsnek, Knysna, Oct., *H. C. Taylor 584* (NBG); Helpmekaar (-DC), Jan., *Compton 10453* (NBG); Peak Formosa, Tsitsikamma mts., Dec., *Esterhuysen 27362* (BOL); Helpmekaar Peak, Jan., *Esterhuysen 4571* (BOL); Between Storms River and Lottering River, Oct., *Fourcade s.n.* (BOL); Half a kilometre south of Peak Formosa, Aug., *Olivier 1407* (NBG); Grenadiers Cap, Tsitsikamma mts., Oct., *Olivier 1412* (NBG); Bloukrans State Forest, path to Kleinheuningbos, July, *H. C. Taylor 9842* (STE).

(11.) *Mimetes palustris* Salisb. ex Knight in Knight, Cult. Prot.: 66 (1809); Phill. and Hutch. in Fl. Cap.: 649 (1912); Phill. in Flower Pl. S. Afr. 1 t. 36 (1921); P. van der Merwe in Landbou Weekblad 15 July 1977: 83 (1977); Rourke in *Mimetes*: 123–129 (1982). Type: without precise locality, growing in wet marshes “in dark uninhabited fruitful mountains”, *Niven s.n.* in herb. R. A. Salisbury (K, lecto!).

Mimetes decapitata Meisn. in DC., Prodr. 14: 262 (1856). Type: In paludosis montium circa Hottentotsholland prope ostium fl. Klynrivier, *Zeyher 3690* ex parte, in herb. Meisner (NY, lecto!).

Low suberect shrub to 0.5 m (very rarely to 1 m) in height, up to 0.7 m in diam., with a single main stem to 5 mm in diam.; bark brown. *Main stem* branching at 50–100 mm, giving rise to a few erect, vigorous, unbranched shoots and numerous lax, laterally sprawling occasionally dichotomous branches; stems 1.5–3 mm in diam., villous, becoming glabrous. Erect shoots producing vigorous inflorescences with 5–12 capitula, laterally sprawling branches bearing 2 or 3 capitula or occasionally a single terminal capitulum. *Leaves* lanceolate-elliptic, 15–20 mm long, 5–10 mm wide, markedly patent on lower branches becoming very broadly ovate, 20 mm long by 15 mm wide and imbricate to clasping on vigorous upright shoots; acute, entire with a small apical callus; densely villous, margins villous-ciliate, later glabrescent. *Inflorescence* narrowly cylindric, 10–45 mm long, consisting of 5–12 axillary capitula. *Capitula* 35 mm long, 3–6-flowered, subtended by a green undifferentiated foliage leaf. *Involucral bracts* imbricate, clasping



FIG. 31

Mimetes palustris (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucral bracts; (E) base of perianth; (F) pollen presenter; (G) hypogynous scales; (H) fruit. Scale lines in millimetres.

perianths at anthesis; outer bracts linear-lanceolate, 15–20 mm long, 2–4 mm wide, green and foliaceous; inner bracts narrowly lanceolate to lanceolate-elliptic, 20–30 mm long, 4–10 mm wide, sharply acute, papyraceous, outer surface sparsely sericeous. *Floral bracts* linear, narrowly lanceolate, 10 mm long, outer surface very densely sericeous. *Perianth* 20–25 mm long; tube quadrangular, 2–3 mm long, glabrous; claws filiform, sericeous, limbs linear-filiform, acute, not differentiated from claws, sericeous to glabrescent. *Anthers* sessile, 2 mm long. *Style* 35 mm long, straight to slightly abaxially arcuate. *Pollen presenter* linear, acute, 2 mm long, with a geniculate annular thickening at junction with style. *Ovary* ovoid, 1–2 mm long, densely puberulous except on adaxial quarter. *Hypogynous scales* linear-subulate, 1 mm long. *Fruits* cylindric, grey-brown, beaked apically, ventral suture prominent, minutely puberulous.

DISTRIBUTION AND HABITAT

Mimetes palustris is endemic to the Klein River mountains, a range which rises steeply from the sea along the southern Cape coast between Hermanus and Stanford. This species is one of the most narrowly endemic of all *Mimetes*. Its total area of distribution scarcely exceeds a few square kilometres. The most westerly populations occur on Platberg in the Fernkloof Nature Reserve, while the most easterly occur some ten kilometres further along the range in an area just beyond Rocklands Peak. Between

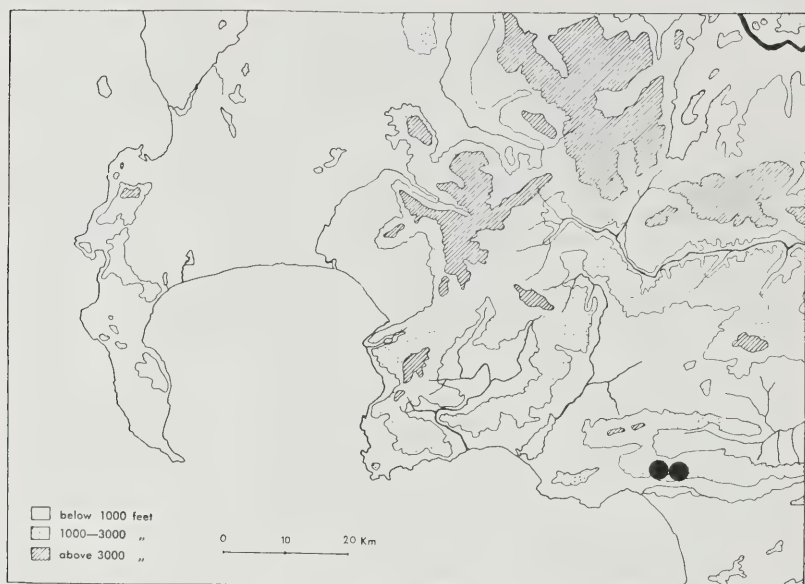


FIG. 32.
Distribution of *Mimetes palustris*.

these two points, in a narrow belt about one kilometre wide, occasional scattered populations can be found.

If the spatial distribution of *Mimetes palustris* is limited, its altitudinal zonation is even more restricted as all known populations occur within a zone between the 600 and 900 metre contours.

Though not a true swamp dweller, *Mimetes palustris* requires permanently moist habitats. It occurs in a variety of niches; on fairly level, open, turfy sites; on the edges of seepage shelves associated with *Roridula gorgonias*, *Erica hispidula*, *Brunia alopecuroides* and *Villarsia ovata*, and even on the steep mossy banks such as are found on shaded south slopes below summit ridges. Always the aspect is south-facing, partly shaded in summer, while often in deep shadow for long periods during winter. Invariably it will be where cool updraughts from moist south easterlies condense to humidify both soil and atmosphere during the dry summer months. In all these situations the soil is exceptionally acid with a high humic content.

An unusual feature of this species is its dimorphic mode of growth,

which is only obvious in fully mature shrubs. At approximately 50 to 100 mm above soil level the single main stem divides into two fairly distinct branch systems; firstly, a series of lax, weakly developed, laterally sprawling, occasionally divided branches; and secondly, several stiffly erect vigorous upright shoots, usually unbranched. Tightly clasping ascending imbricate leaves cover the strong upright branches, while the diffuse lateral branches are covered with loosely arranged patent leaves. As the lateral branches are often concealed amongst the associated vegetation, *M. palustris* tends to be very cryptic and easily overlooked. Only the erect shoots are usually tall enough to attract attention. Occasionally these shoots have been known to reach a metre in height but this is clearly exceptional. Most mature shrubs rarely produce upright growths more than half a metre in height.

Populations of *Mimetes palustris* may vary from less than a dozen plants to almost three hundred individuals, yet even large groups are easily overlooked as they are so cryptically concealed in the surrounding vegetation. The characteristically low stature of this species, coupled with an essentially winter-flowering habit, results in an uneven development of axillary capitula, due to the low winter sun. What invariably happens is that the axillary capitula develop on one side of the inflorescence—the side on which most sunlight falls. This is usually the north side of a flowering shoot but in some situations, depending on the light-blocking effect of adjacent mountain peaks, the axillary capitula develop on the south east-facing side of the erect flowering shoots.

Another singular feature, peculiar to this species, is the development of terminal, as well as axillary capitula. The typical axillary capitula are produced on the upright branch system, while single terminal capitula are occasionally borne at the apices of the lax, rather diffuse, lateral branches.

Mimetes palustris has a rather ill-defined flowering period though it is best described as winter-flowering. The capitula in each inflorescence open sporadically over a period of time, from early July until late November. Furthermore, they do not open in strict acropetal succession and so both fruiting and unopened capitula can usually be found in each inflorescence. Fruits mature approximately four months after pollination has taken place. In the post-pollination phase the developing fruits are clasped within a fleshy envelope formed by the involucrel bracts. When mature, an abscission layer develops at the axillary capitulum's point of attachment to the main stem, thereby interrupting the vascular supply, which soon results in the bracts losing their turgidity. As the involucrel bracts dry out still further, they become completely everted, expelling the now mature fruit in the process.

DIAGNOSTIC CHARACTERS

Among those *Mimetes* having linear-subulate styles and entire leaves, *M. palustris* is readily distinguished by its short styles, 30 to 35 mm in length.

SPECIMENS EXAMINED

CAPE PROVINCE—3419 (Caledon): Stanford mtns. (-AD), July, *Stokoe 9499*✓ (PRE); Klein River mtns., Aug., *Stokoe 16613* (BOL); Klein River mtns., Sept., *Estherhuysen 4373* (BOL); Klein River mtns., between waterfalls and Rocklands Peak, *Stokoe s.n.* (BOL); In very wet soil near stream on top of Klein River mtns., *Stokoe NBG 1868/28* (BOL); Aasvoelkop above Hermanus, Sept., *Rourke 1246* (NBG); East of summit of Aasvoelkop above Mossel River, July, *Williams 1436* (NBG); Between waterfall and Rocklands Peak, Klein River mtns., *Stokoe s.n.* (SAM 541760); Rocklands Peak, Aug/Sept., *Stokoe s.n.* (SAM 19856); East of Rocklands Peak, Sept., *Stokoe s.n.* (SAM 56245); Klein River mtns., Aug., *Stokoe s.n.* (SAM 28393); Between Hermanus and Stanford, Aug., *Stokoe 1418* (K); Fern Kloof Nature Reserve, June, *Orchard 407* (STE); Platberg, western end of Klein River Mountains, Hermanus, Oct., *Rourke 1493* (NBG, PRE, MO, K, S).✓

✓ (12.) *Mimetes capitulatus* R. Br. in Trans. Linn. Soc. Lond. **10**: 106 (1810); Meisn in DC., Prodr. **14**: 262 (1856); Phill. & Hutch. in Fl. Cap. **5**: 644 (1912); Phill. in Flower. Pl. S. Afr. **2**: t 58 (1922); Rousseau, Proteaceae of S. Afr.: 62 (1970); P. van der Merwe in Landbou Weekblad 15 July 1977: 82 (1977); Rourke in *Mimetes*: 133–139 (1982). Type: “2 *Mimetes capitulata* Africa australis”, so labelled in R. Brown’s hand taken as lectotype (BM, lecto!). W. Roxburgh is given as collector in type description but no collector’s name is inscribed on the above sheet.

Protea capitulata (R. Br.) Poir., Encycl. meth. Bot. Suppl. **4**: 568 (1816).

An erect rounded shrub to 2 m, with a single main stem; crown compact, densely branched; with age developing several erect, usually unbranched straggling shoots. Branches 5–8 mm in diam., villous initially, later glabrous. Leaves ascending imbricate, lanceolate to broadly lanceolate to ovate, 20–35 mm long, 8–20 mm wide, sharply acute, entire, with a single thickened apical callus; hispidly villous initially, later glabrescent. Inflorescence cylindrical, 60–100 mm long, 60–80 mm wide, terminated by an erect shoot of foliage leaves, not differentiated into a distinct coma. Capitula 10 to 13, usually 11-flowered; subtended by a broadly ovate foliage leaf occasionally tinged carmine during anthesis, 25–40 mm long, 15–20 mm wide, very densely hispid, margins hispidly ciliate. Outer involucral bracts very narrowly lanceolate to linear, 15–25 mm long, 3–6 mm wide, erect and ascending, greenish-white, carmine-flushed, tomentose; inner bracts lanceolate to broadly lanceolate, sharply acute, 15–40 mm long, 8–14 mm wide, orange-red, hyaline and glabrous proximally, softly puberulous distally. Floral bracts narrowly



FIG. 33.

Mimetes capitatus (A) leaf; (B) axillary capitulum; (C) single flower; (D) involucre bracts; (E) floral bracts; (F) pollen presenter; (G) base of perianth; (H) hypogynous scales; (I) fruits. Scale in millimetres.

lanceolate-acute, 30–35 mm long, 5–10 mm wide, orange-red,⁴ glabrous proximally, puberulous and ciliate distally. *Perianth* 30–40 mm long, tube glabrous proximally, slightly inflated, 5–7 mm long; claws filiform, sericeous, limbs linear-acute, densely sericeous. *Anthers* 4 mm long, sessile. *Style* 45–55 mm long elongating at anthesis and becoming strongly arcuate, straightening later. *Pollen presenter* 5–7 mm long, annulately swollen at junction with style, narrowing and becoming capitate to conic-acute at apex; stigmatic groove terminal. *Ovary* ovoid, 2 mm long, sericeous. *Hypogynous scales* linear-obtuse, fleshy, 2 mm long. *Fruits* cylindric, 5–6 mm long, 2–3 mm wide, minutely puberulous.

DISTRIBUTION AND HABITAT

This rare species has a rather fragmented distribution range in the coastal mountains of the south western Cape. Most populations are scattered on the higher mountains surrounding the drainage basin of the Palmiet River; notably on Kogelberg and adjacent peaks, on Paardeberg near Kleinmond, and along Groenlandberg above Grabouw. Outlying populations

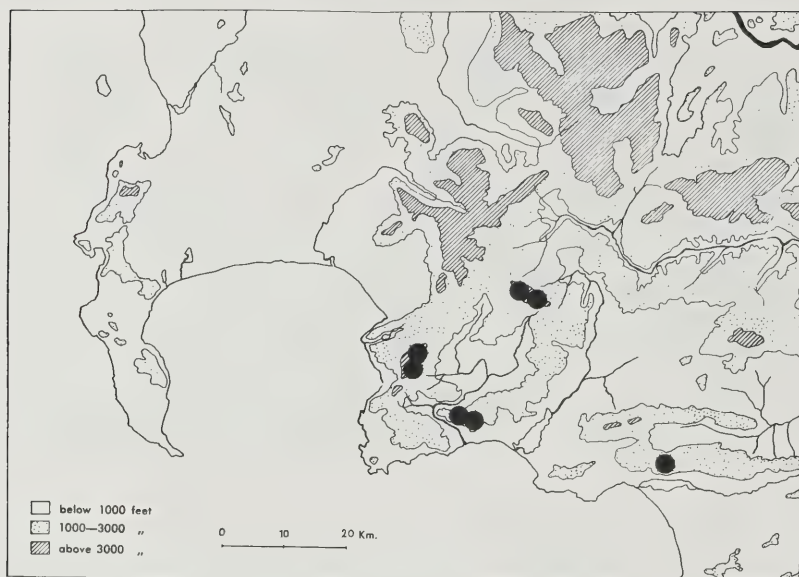


FIG. 34.
Distribution of *Mimetes capitulatus*.

have also been recorded from the Klein River Mountains at Hermanus but there have been no confirmed sightings there in recent years.

With the exception of the various populations on Groenlandberg, which may on occasions consist of as many as a thousand individuals in total, practically all other known stands of *Mimetes capitulatus* contain no more than about a hundred plants and may often be composed of as few as a dozen. The reasons for this natural rarity are not clear but it is likely that very specific habitat requirements could be a limiting factor.

Mimetes capitulatus, like its near relatives *M. hirtus* and *M. palustris*, requires permanently moist, even swampy growing conditions. It is moreover, a montane species confined to Table Mountain Sandstone peaks that are either immediately or nearly adjacent to the sea, at elevations varying from 600 to 1 200 m. Whether situated at the uppermost or lowermost levels of this altitudinal range, most populations are found immediately below a summit or summit ridge on cool, south east-facing slopes. It is at these particular sites that clouds, driven in by summer south easters, condense to precipitate their moisture loads during otherwise rainless periods. Deep, peaty

sponges develop here with water slowly percolating through the intensely acid humus-rich substratum. These distinctive seeps are marked by a prominent swamp flora with other moisture-loving species like *Berzelia ecklonii*, *Brunia alopecuroides*, *Chondropetalum mucronatum* and *Klattia partita*, often occurring in dense association.

Robust young plants at between five and ten years of age form rounded shrubs to about a metre in height. At this stage they flower profusely. However, as they age, the rounded bushy form remains but in addition, several erect, largely undivided and rather lanky branches develop, sometimes attaining two metres. These shoots eventually become quite devoid of leaves except on the ultimate and penultimate growth flushes which continue to bear inflorescences, while the lower bushy growths produce very few flower-heads. The development of this mode of growth marks the onset of senescence. Flowering diminishes, growth increments shorten and leaves are shed. After about their twentieth year most plants in a population have become depauperate or moribund. Few survive for more than thirty years. Like so many other montane proteaceous shrubs from moist habitats, *Mimetes capitulatus* is essentially short-lived and depends on periodic cyclical burns to rejuvenate senescent populations. Indeed, it is probable that a burn once every twenty years is essential to the maintenance of viable populations of this species.

Mimetes capitulatus flowers from late winter until early summer, opening towards the middle of June and continuing until December. August, however, is the peak of the flowering season. The fruits mature during summer and can be gathered from November until February, depending on local conditions.

DIAGNOSTIC CHARACTERS

Among *Mimetes* having prominent yellow to red involucre bracts and entire leaves, *Mimetes capitulatus* is distinguished by its unique pollen presenter which is capitate to conic-acute at the apex, then cylindric and becoming annulately swollen at its junction with the style.

SPECIMENS EXAMINED

CAPE PROVINCE—3418 (Simonstown): Kogelberg (-BB), Nov., *Stokoe s.n.* (SAM 56266); Landward side of Kogelberg, Aug., *Stokoe 871* (PRE); Kogelberg Forest Reserve, slopes of Spinnepopsnes, Nov., *Ryerhof 1450* (BOL, NRG); Kogelberg summit, Nov., *Jackson s.n.* (NBG 56375); Near Hangslip (BD), Aug., *Stokoe s.n.* (PRE 1457)—painted by Miss Lansdell for Flowering Plants of S.A.; Paardeberg, Kogelberg, March, *Vogts 73* (PRE, STE); Palmiet River, *Stokoe 655* (BOL); Palmiet River, Paardeberg mountains, Oct., *Stokoe s.n.* (SAM 25264); Paardeberg, above mouth of Palmiet River, Dec., *Roult 20* (NBG); Summit of Paardeberg overlooking Fairy Glen, Feb., *Boucher 1156* (STE).

—3419 (Caledon): Lebanon Forest Reserve (-AA), June, *Kruger 84* (STE); Mt. Lebanon, Groenlandberg Range, Aug., *Rourke 1485* (NBG, MO, K, PRE); Mt. Lebanon, Elgin, Oct., *Oliver 3008* (STE); Grietjies gat, Aug., *Zeyher 3690* (SAM); Bankrot Kloof, Elgin district, *J. S. Linley s.n.* (SAM 60919); Lebanon Forest Reserve, Sept., *Martin 1037* (NBG); South east slopes of Groenlandberg, in kloof below Mt. Lebanon, Sept., *Rourke 1103* (NBG); Kleinmond (-AC), Sept., *Le Roux s.n.* (STE 11467); Klein River mts. (-AD), *Stokoe s.n.* (SAM 44592); Mountains above Klein River Mouth, May, *Stokoe 8375* (BOL).

SPECIES NON SATIS COGNITAE

Mimetes floccosa Salisb. ex Knight in Knight, Cult. Prot.: (1809); Phill. & Hutch. in Fl. Cap 5: 649 (1912). Type: "A species discovered in Hottentots Holland by Mr. F. Masson", according to original description but no type specimen has been traced.

Phillips and Hutchinson (1912) regarded this as an imperfectly known species, noting that "Masson's type appears to be lost." I have also failed to trace Masson's type despite several careful searches at BM, K, and other European herbaria where Masson's specimens are thought to be preserved. The original description is so brief and so vague as to be equally applicable to several species of *Mimetes*. Consequently, until the type specimen comes to light, *Mimetes floccosa* Salisb. ex Knight, must be regarded as insufficiently known.

HYBRIDS

Natural interspecific hybrids in *Mimetes* are rare. The only recorded instances of natural hybridisation are those detailed below:

(1) *M. cucullatus* x *M. fimbriifolius*

Several collections of natural hybrids between the two above-mentioned species have been made at various places on the Cape Peninsula, where the parent species occur sympatrically. Though morphologically intermediate between the parent species, the hybrids tend to resemble *M. cucullatus* in growth habit. Their basal stems are usually very stout, covered with thick cartilaginous bark.

The following collections have been examined:

CAPE PROVINCE—3418 (Simonstown): Rocklands neck at head of Klaver Valley, on south west slopes of Swartkop (-AB), April, *Rourke 1713* (NBG, PRE); South slopes of Rooihoogete near Smithwinkel (-AD), Nov., *L. Guthrie* in herb T. M. Salter 8551 (NBG, K); East side of Rooihoogete, Cape Peninsula, *Garside 5045* (BOL); presumed parents from same locality are *M. fimbriifolius* (*Garside 5044* in BOL) and *M. cucullatus* (*Garside 5046* in BOL).

(2) *M. hirtus* x *M. capitulatus*

Material of this hybrid has been in cultivation at Kirstenbosch since

1978, after having been collected from a natural hybrid growing in a population of *M. capitulatus*.

The following collection has been examined:

CAPE PROVINCE—3418 (Simonstown): Perdepeak (-BD), 2100 ft, 2/8/1978, B. B. Tarr s.n. (NBG).

ACKNOWLEDGEMENTS

The author wishes to express his thanks to the directors of the following herbaria for freely granting access to collections in their care, as well as for the loan of type material: BM, K, Z, PH, L, LY, BOL, PRE, STE, UPS (Herb. Thunberg) and LINN. All material quoted in this paper has been examined by the author, unless the contrary is indicated.

Mr. J. H. Winter, Curator of Kirstenbosch, and his horticultural staff, are warmly thanked, not only for accompanying me on field excursions to study living species in their natural habitats, but also for their interest in building up a comprehensive living study collection of *Mimetes* at Kirstenbosch, during the past ten years.

Grateful thanks are also due to the Directorate of Forestry (Department of Environment Affairs) for granting permission to study *Mimetes* in various forest reserves in the south western Cape.

The drawings of floral dissections are the work of Mrs. L. S. Davis, while the diagrams in Figs 3 and 26 were prepared by Mrs. J. Loedolff.

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**THE CYTOLOGY OF THE GENUS *HAEMANTHUS* L.
(AMARYLLIDACEAE)**

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ABSTRACT

A cytological survey of fifteen species and five subspecies of the genus *Haemanthus*, using conventional staining as well as Quinacrine fluorescence and C-banding techniques, has confirmed its chromosome number uniformity: all the species have a chromosome complement of $2n = 2x = 16$. Chromosome rearrangements, including translocations and pericentric inversions, allow the species to be subdivided into two discrete Groups with three Sections each. Overall chromosome differentiation between the species conforms with the conventional taxonomy of the genus. Two species, *H. albiflos* and *H. strigosus* (*H. humilis* complex) have been found to possess two distinct chromosome races. In the case of *H. albiflos* a spontaneous hybrid between its two races is described. Two species, *H. coccineus* and *H. unifolius*, have B-chromosomes.

UITTREKSEL

DIE SITOLOGIE VAN DIE GENUS *HAEMANTHUS* L. (AMARYLLIDACEAE)

'n Sitologiese opname van vyftien spesies en vyf subspesies van die genus *Haemanthus* waarvoor konvensionele kleurtegniese sowel as kienakrien-fluoresensie en C-band tegnieke gebruik is, het bevestig dat die chromosoomgetal eenvormig is: al die spesies het 'n chromosoomgetal van $2n = 2x = 16$. Dit is moontlik om die spesies in twee groepe met drie seksies elk te verdeel deur van chromosoomherrangskikkings, wat translokasie en perisentriese omkerings insluit, gebruik te maak. Algemene chromosoomdifferensiasie tussen die spesies stem ooreen met konvensionele taksonomie van die genus. Twee spesies, *H. albiflos* en *H. strigosus* (*H. humilis* kompleks) blyk twee onderskeie chromosoomrasse te hê. In die geval van *H. albiflos* word 'n spontane kruising tussen die twee rasse beskryf. Twee spesies, *H. coccineus* en *H. unifolius*, het B-chromosome.

Key words: *Haemanthus*, chromosome evolution, taxonomy.

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INTRODUCTION

A chromosome study of nine species of *Haemanthus* has been recently published (Vosa & Marchi, 1980). The present paper presents the cytological analysis of fifteen species and five subspecies out of the twenty-six taxa so far recognised in the genus. It is presented in conjunction with the most recent taxonomic survey (Snijman, 1984) and includes chromosome studies of all the species under cultivation, together with a discussion on chromosome evolution within the genus.

MATERIAL AND METHODS

All the species used in the present study were collected in the wild. Collection data are indicated in Table 1.

For the cytological preparation generally, actively growing root-tips were pretreated with an aqueous solution of colchicine (0.05 %) for 4–5 hours at room temperature. After pretreating and in order to avoid chromosome "bubbling", the root-tips were washed in distilled water, dried quickly on filter paper and placed in 1 : 3 acetic-alcohol for a half-hour. The root-tips were then removed, dried again on filter paper and placed in fresh fixative overnight.

Staining was performed in Feulgen. C-banding and Quinacrine fluorescence staining methods were those used by Vosa (1973).

The haploid ideograms were prepared with measurements taken with camera lucida on at least five mitotic metaphases for each species, on several individuals where possible. Care was taken to choose equally contracted chromosomes in all cases.

In the ideograms the chromosomes are arranged in sequence according to decreasing length from left to right.

Small secondary constrictions are often visible in some of the chromosomes: in the drawings they are indicated by broken lines.

Micrographs were taken on permanent preparations with a Zeiss Ultraphot II microscope using REKORDAK AHU microfilm (Kodak).

In all micrographs the bar represents 10 μ .

RESULTS AND DISCUSSIONS

The results of this investigation confirm the earlier findings that the genus *Haemanthus* is chromosomally uniform.

One of its characteristics is the very large chromosomes and the absence of heterochromatic blocks (Vosa & Marchi, 1980). There are no chromocentres in the interphase nuclei and C-banding produces only very thin bands adjacent to the nucleolar attachments.

TABLE 1
Collection data of *Haemanthus* species.

Species	Collector's name and number
1. <i>humilis</i> Jacq. subsp. <i>hirsutus</i> (Baker) Snijman	Matthews 886 (OXF)
" " " " " "	Matthews 894 (NBG)
" " " " " "	Matthews 933 (NBG)
" " " " " "	Matthews 1015 (NBG)
2. <i>montanus</i> Baker	Lavranos s.n. (OXF)
3. <i>crispus</i> Snijman	Hardick
" "	sub NBG 889/71 (NBG)
" "	Snijman 428 (NBG)
4. <i>strigosus</i> Herbert (<i>humilis</i> Jacq. subsp. <i>humilis</i>)	
" " (A)	Batten 591 (NBG)
" " (A)	Vosa 2059 (OXF)
" " (A)	Vosa 2056 (OXF)
" " (B)	Snijman 471 (NBG, OXF)
5. <i>barkeræ</i> Snijman	Hiemstra & Hardick
" "	sub NBG 899/71 (NBG)
" "	Snijman 96 (NBG)
6. <i>namaquensis</i> R. A. Dyer	Snijman 159 (NBG)
7. <i>albifolius</i> Jacq. ST5	Roux 307 (NBG)
" " SM5	Roux 90 (NBG)
" " ST5	Snijman 468 (NBG)
" " SM5	Snijman 492 (NBG)
" " ST5	van Jaarsveld 6834 (OXF)
" " SM5	van Jaarsveld 6844 (OXF)
" " SM5	van Jaarsveld 6908 (OXF)
" " ST5	van Jaarsveld 6913 (OXF)
" " ST5 × SM5	Vosa 381/79 (OXF)
" " ST5	Vosa 1477 (OXF)
" " ST5	Vosa 1497 (OXF)
" " SM5	Vosa 1519 (OXF)
" " ST5	Vosa 2160 (OXF)
" " SM5	Vosa 2181 (OXF)
" " ST5	Vosa 2202 (OXF)
" " ST5	Vosa 2205 (OXF)
" " SM5	Vosa 2056 (OXF)
8. <i>sanguineus</i> Jacq.	Moriarty 321 (NBG)
" "	Rourke 1665 (NBG)
" "	Snijman 95 (NBG)
9. <i>canaliculatus</i> Levyns	van Essen s.n. (NBG)
10. <i>pumilio</i> Jacq.	Olivier 152 (NBG)
" "	Snijman 248 (NBG)
11. <i>lanceifolius</i> Jacq.	Snijman 147 (NBG)

12. <i>amarylloides</i> Jacq. subsp. <i>amarylloides</i>	Snijman 599	(NBG)
" " " <i>polyanthus</i> Snijman	Snijman 415	(NBG)
" " " <i>toximontanus</i> Snijman	Olivier 193	(NBG)
13. <i>graniticus</i> Snijman	Snijman 424	(NBG)
14. <i>coccineus</i> L.	Hiemstra 120	(NBG)
" " " " " " " " " "	Snijman 3	(NBG)
" " " " " " " " "	Stayner	
	sub NBG 1026/71	(NBG)
15. <i>unifolius</i> Snijman	du Plessis 417	(NBG)
" " " " " " " " "	Snijman 158	(NBG)
16. <i>pubescens</i> L.f. subsp. <i>pubescens</i>	Snijman 89	(NBG)
" " " " " " " " "	Snijman 430	(NBG)
" " " " " " " " "	van Berkel 313	(NBG)

TABLE 2
Previous chromosome counts in the genus *Haemanthus*

Species	2n =	Author and year
<i>albiflos</i> Jacq.	16	Inariyama, 1937; Sato, 1938, 1942; Tjio and Levan, 1950; Bjørnstad and Friis, 1972; Vosa and Marchi, 1980.
" " (as <i>albiflorus</i> *)	16	Heitz, 1926.
" " (as <i>albomaculatus</i> Baker)	16	Vosa and Marchi, 1980.
<i>montanus</i> Baker (as <i>amarylloides</i> Jacq.)	16	Brighton (quoted by Bjørnstad and Friis, 1972).
<i>carneus</i> Ker Gawler	16	Vosa and Marchi, 1980.
<i>coccineus</i> L.	16	Inariyama, 1937; Sato, 1938, 1942; Bjørnstad and Friis, 1972; Vosa and Marchi, 1980.
" " var. <i>coarctatus</i> Baker	16	Heitz, 1926.
" " (as <i>hyalocarpus</i> Jacq.)	16	Vosa and Marchi, 1980.
" " (as <i>tigrinus</i> Jacq.)	16	Gouws, 1964; Vosa and Marchi, 1980.
<i>fimbriatus</i> *	16	Heitz, 1926.
<i>humilis</i> Jacq. (as <i>hirsutus</i> Baker)	16	Gouws, 1949.
" " (as <i>nelsonii</i> Baker)	16	Gouws, 1949; Vosa and Marchi, 1980.
<i>pubescens</i> L.f.	16	Vosa and Marchi, 1980.
" " var. <i>hirsutus</i> *	16	Heitz, 1926.
<i>sanguineus</i> Jacq. (as <i>rotundifolius</i> Ker Gawler)	16	Vosa and Marchi, 1980.

*nomina nuda

With Quinacrine staining the chromosomes of *Haemanthus* fluoresce evenly along their length.

All the species so far investigated have a chromosome number of $2n = 16$ and a bimodal karyotype consisting of five or six pairs of large chromosomes (L) and three or two pairs of small chromosomes (S).

Previous chromosome counts in the genus are indicated in Table 2.

It has been shown that *Haemanthus* originated from the allied and less specialised genus *Scadoxus*, by a chromosome translocation which resulted in the dispoloid reduction of the chromosome number from $2n = 18$ to $2n = 16$ (Vosa & Marchi, 1980, and Fig. 1).

On the basis of chromosome analysis, the twenty taxa studied can be subdivided into two discrete Groups, *L*- and *S*-. The denominations *L*- and *S*- refer to the possession of a longer short-arm or a shorter short-arm of chromosome 1, respectively (Fig. 1 and Table 5).

Group *L*- includes seventeen taxa where chromosome 1 is submedian with an arm ratio from about 2.0 to 2.7 and Group *S*- includes four species where chromosome 1 is subterminal with an arm ratio of about 4.8 to 6.5 (Tables 3 and 4).

The mutation responsible for the change in arm ratio of chromosome 1 involves the translocation of a relatively large segment between the short arm of chromosome 1 and the long arm of chromosome 6 (Figs 1 and 2).

Taking into account significant chromosome rearrangements, the two Groups can be further subdivided into three Sections each (Fig. 1 and Table 5).

In all the species the nucleolar organiser, in the form of a small trabant, is always distally located. It may be found in the short-arm or sometimes in the long-arm and in most cases in the largest chromosomes of the complement. It is usually found in a heterozygous condition and its location is variable even within the same species (Vosa & Marchi, l.c.). In the ideograms its position is indicated by a small circle.

In the course of the present study a population of a race of *H. albiflos* (race ST5, see below) was found to be chromosomally heterogeneous. Of nine individuals analysed, three had nucleolar attachments in the short-arm of chromosome 1, two had nucleolar attachments in the long-arm of chromosome 5, and in the remaining three the nucleolar attachments were present in both chromosomes. In all individuals the nucleolar attachments were in a heteromorphic condition.

The chromosome situation in *H. albiflos* presents special problems. The species is widespread along the eastern coast of southern Africa. Two distinct chromosome races are present: one which is indistinguishable from Section *L*-1 (race SM5 = submedian chromosome 5, Figs 7a and 12n) and one which represents Section *L*-3 (race ST5 = subterminal chromosome 5, Figs 1d, 8a and 13c).

TABLE 3

Chromosome measurements in μ , arm ratio and type of the haploid complement of three species of *Haemanthus* (Group L-).

Haemanthus pumilio [L-1]

	1	2	3	4	5	6	7	8	Totals
S	6,75	2,90	1,60	2,50	3,40	1,80	2,50	1,80	23,25
L	13,95	13,50	13,70	9,20	7,65	4,45	2,70	2,65	67,80
Totals	20,70	16,40	15,30	11,70	11,05	6,25	5,20	4,45	91,05
S/L	2,06	4,65	8,56	3,68	2,25	2,47	1,08	1,47	
Type	sm	st	t	st	sm	sm	m	m	

Haemanthus amarylloides subsp. *amarylloides* [L-2]

	1	2	3	4	5	6	7	8	Totals
S	5,40	2,50	1,30	2,50	1,10	2,00	2,50	1,80	19,10
L	14,70	14,20	13,70	9,90	8,10	4,50	2,70	3,00	70,80
Totals	20,10	16,70	15,00	12,40	9,20	6,50	5,20	4,80	89,90
S/L	2,72	5,68	10,50	3,96	7,36	2,25	1,08	1,60	
Type	sm	st	t	st	t	sm	m	m	

Haemanthus albiflos ST5 [L-3]

	1	2	3	4	5	6	7	8	Totals
S	5,60	2,25	1,10	2,30	0,70	2,70	1,35	1,80	17,80
L	14,20	14,15	13,50	10,35	7,90	5,30	3,80	3,00	72,20
Totals	19,80	16,40	14,60	12,65	8,60	8,00	5,15	4,80	90,00
S/L	2,53	6,28	12,27	4,50	11,28	1,96	2,81	1,66	
Type	sm	st	t	st	t	sm	sm	m	

TABLE 4

Chromosome measurements in μ , arm ratio and type of the haploid complement of three species of *Haemanthus* (Group S-).

Haemanthus crispus [S-1]

	1	2	3	4	5	6	7	8	Totals
S	2,10	1,95	1,15	1,85	3,25	3,00	1,40	1,50	16,20
L	13,70	12,55	12,80	10,30	8,40	6,95	4,40	2,80	71,90
Totals	15,80	14,50	13,95	12,15	11,65	9,95	5,80	4,30	88,10
S/L	6,52	6,43	11,13	5,56	2,58	2,31	3,14	1,86	
Types	st	st	t	st	sm	sm	st	sm	

Haemanthus barkerae [S-2]

	1	2	3	4	5	6	7	8	Totals
S	2,35	2,25	1,45	2,65	3,80	1,70	1,65	2,05	17,90
L	13,80	12,35	12,95	10,30	8,80	6,45	4,40	2,95	72,00
Totals	16,15	14,60	14,40	12,95	12,60	8,15	6,05	5,00	89,90
S/L	5,87	5,48	8,93	3,88	2,31	3,79	2,66	1,43	
Types	st	st	t	st	sm	st	sm	m	

Haemanthus namaquensis [S-3]

	1	2	3	4	5	6	7	8	Totals
S	2,75	1,70	1,40	2,65	3,25	3,85	1,65	1,70	18,95
L	13,30	12,90	12,35	10,45	8,15	5,75	4,10	2,75	69,85
Totals	16,05	14,60	13,75	13,10	11,50	9,60	5,75	4,45	88,80
S/L	4,83	7,58	8,82	3,94	2,53	1,49	2,48	1,61	
Types	st	t	t	st	sm	m	sm	m	

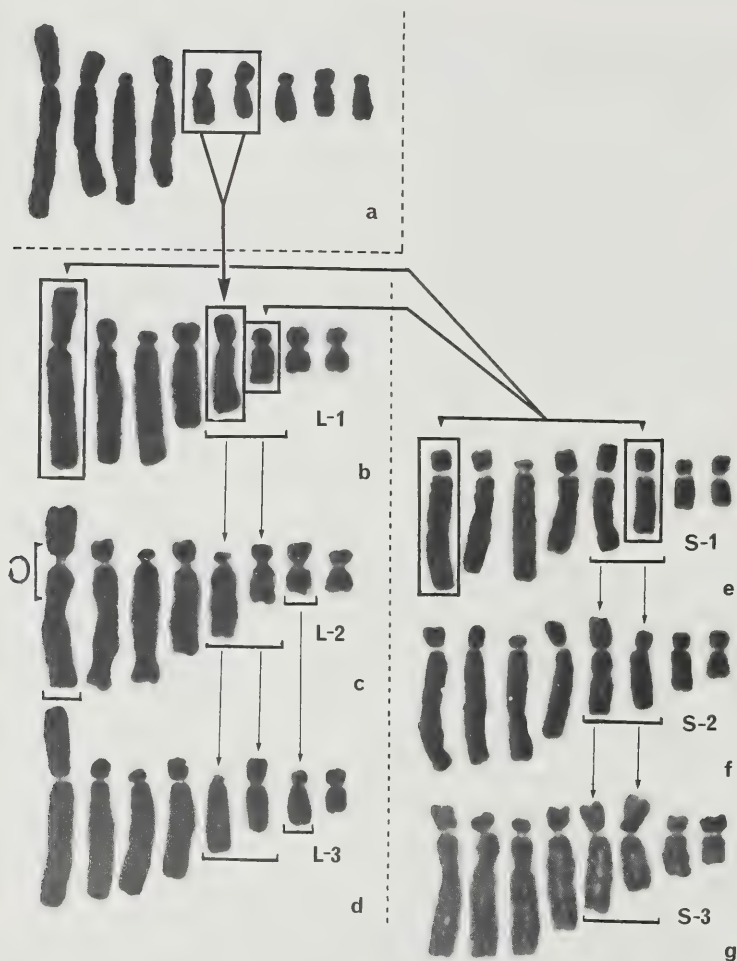


FIG. 1.

The chromosome relationship between *Scadoxus* and *Haemanthus* and within *Haemanthus*, between its two Groups and six Sections. The main chromosomal rearrangements responsible for the differentiation between *Scadoxus* and *Haemanthus* (see Vosa and Marchi, 1980) and between the two Groups of species in *Haemanthus* are indicated by boxing and connected by heavy lines and arrows. The rearrangements between the Sections (within the Groups) by underlining. The small arrows show the probable sequences of rearrangements. a, Haploid complement of *Scadoxus puniceus*; b, *Haemanthus pumilio* [L-1]; c, *H. amarylloides* subsp. *amarylloides* (L-2); d, *H. albiflos* ST5 [L-3]; e, *H. crispus* [S-1]; f, *H. barkerae* [S-2]; g, *H. namaquensis* [S-3].



FIG. 2.

Reconstruction of the assumed translocation between chromosome 1 and 6 in *Haemanthus*, responsible for the splitting of the genus into the L- and the S-Groups. The arrows and the lines indicate the points of breakage and reunion and the direction of the translocation.

Sixteen collections have been analysed and no obvious geographical or ecological correlation has been found.

The proportion of the two races in the sixteen collections is about equal with nine of race ST5 and seven of race SM5.

Overall the two races are morphologically similar. However, under cool greenhouse conditions, race ST5 flowers earlier in the year and more regularly than race SM5.

It is probable that we are witnessing here one of the first events in speciation, where two races of the same species, though still phenotypically similar, have already begun to diverge genetically.

One plant of *H. albiflos* from the Bloukrans area, near Grahamstown, has proved to be a hybrid between the two chromosome races. Morphologically it is indistinguishable from typical *H. albiflos* sens. lat. It grows well under ordinary cool greenhouse conditions, but it rarely flowers. Its chromosome complement is illustrated in Figs 11a and 11b.

One plant of *H. canaliculatus* has been found to have a translocation between chromosomes 2 and 3. This is present in heterozygous conditions and is illustrated in Figs 10a and 10b.

B-chromosomes have been found in only two species, *H. coccineus*, in one plant collected at the foot of Jonas Kop (3319-CD: Worcester) illustrated in Fig. 5c, and in a plant of *H. unifolius*, collected SW of Steinkopf (2917-BC: Springbok). In both species they are very small and telocentric.

Their existence in two distinct species, far apart geographically, and their identity in size and shape, points to their great antiquity in the phylogeny of the genus.

TABLE 5
Chromosome Classification of the Genus *Haemanthus*

GROUP L-	GROUP S-
Section 1	Section 1
<i>humilis</i> subsp. <i>hirsutus</i>	<i>crispus</i>
<i>montanus</i>	<i>strigosus</i> A (<i>humilis</i> subsp. <i>humilis</i>)
<i>sanguineus</i>	
<i>canaliculatus</i>	Section 2
<i>pumilio</i>	<i>barkerae</i>
<i>lanceifolius</i>	
<i>amarylloides</i> subsp. <i>polyanthus</i>	Section 3
<i>amarylloides</i> subsp. <i>toximontanus</i>	<i>namaquensis</i>
<i>graniticus</i>	
<i>coccineus</i>	
<i>unifoliatus</i>	
<i>pubescens</i> subsp. <i>pubescens</i>	
<i>pubescens</i> subsp. <i>leipoldtii</i>	
<i>albiflos</i> SM5	
<i>strigosus</i> B (<i>humilis</i> subsp. <i>humilis</i>)	
Section 2	
<i>amarylloides</i> subsp. <i>amarylloides</i>	
<i>pubescens</i> subsp. <i>arenicolus</i>	
Section 3	
<i>albiflos</i> ST5	

DESCRIPTION OF THE KARYOTYPES

Mitotic metaphases and diagrammatic representations of the haploid karyotypes of all the species are illustrated in Figs 3 to 13.

Group L: for the purpose of comparison, Section *L*-1, the largest of the Group, with fifteen taxa (see Table 5), is taken as basic (Fig. 1b; Figs 3a, b, c; 4a, b, c; 5a, b, c; 6a, b, c; 7a; 10a; 12a to 12n).

Section *L*-2 includes two taxa, *H. pubescens* subsp. *arenicolus* and *H. amarylloides* subsp. *amarylloides*. It differs from Section *L*-1 in the interchange between a segment of the short-arm of chromosomes 5 and 6 and in the probable pericentric inversion of chromosome 1 (Figs 1c, 7b, 7c, 13a and 13b).

Section *L*-3 includes the ST5 race of *H. albiflos*. It differs from Section *L*-1 in a probable complex interchange between chromosomes 5 and 6 resulting in the change from submedian to subterminal and from subterminal to submedian, respectively, and in the pericentric inversion of chromosome 7 (Figs 1d, 8a and 13c).

Group S: for the purpose of comparison Section *S*-1 is taken as basic. It includes two species, *H. crispus* and race A of *H. strigosus* (see below), and

their mitotic chromosomes and basic karyotypes are illustrated in Figs 1e, 8b, 8c, 13d and 13e.

In the taxonomic treatment *H. strigosus* has been placed within *H. humilis* complex (Snijman, 1984).

Four collections have been analysed, three (*Batten* 591; *Vosa* 2059 and 2056) have a chromosome complement which belongs to the *S*-Group, Section 1, together with *H. crispus*. These three collections are indicated by the letter A in Table 1. The karyotype of the other collection, *Snijman* 471, belongs to the *L*-Group, Section 1, and is indicated by the letter B in Table 1.

The *H. humilis* complex is very polymorphic and detailed studies on more extensive field collections are needed to clarify the situation. For a discussion of the taxonomic problems in this complex see the taxonomic treatment (Snijman, 1984).

Section *S*-2 includes *H. barkerae*, and differs from Section *S*-1 in a pericentric inversion which has altered the morphology of chromosome 5 from submedian to median (Figs 1f, 9a and 13f).

Section *S*-3 includes *H. namaquensis* and differs from Section *S*-1 in a complex interchange and possible inversion which has altered the morphology of chromosomes 5 and 6 (Figs 1g, 9b and 13g).

The presence of a similar chromosome 1 in *Scadoxus* and in the *L*-Group of *Haemanthus* is an indication that this Group is the most primitive.

It is interesting to note that only chromosomes 1, 4, 5 and 6 are involved in the major rearrangements resulting in the differentiation in both Groups of *Haemanthus* and, indeed, chromosome 6 in the origin of *Haemanthus* itself from a *Scadoxus* ancestor (Figs 1a and 1b and see *Vosa & Marchi*, l.c.).

Further, the observation of a small secondary constriction in the short-arm of chromosome 1 in some of the *L*-Group species (Figs 3a, 3b, 3c, 4a, 12a, 12b, 12c and 12e), in a position more or less corresponding with the translocation break-point, resulting in the *L*- to *S*-Group differentiation, may be an indication of a structural predisposition to breakage.

It is possible, in fact, to speculate that there exists a genetically controlled variability in this group of chromosomes resulting in the discontinuities on which the selective forces work and is responsible for speciation.

Chromosome measurements, taken on one species for each Section in the two Groups (Tables 3 and 4), show very well their differences as well as their obvious similarities. In particular, the total chromosome length of the haploid karyotypes is shown to vary very little. Taking into account some probable small deletions and/or duplications, it is remarkably uniform for the genus, in spite of the relatively large chromosome rearrangements.

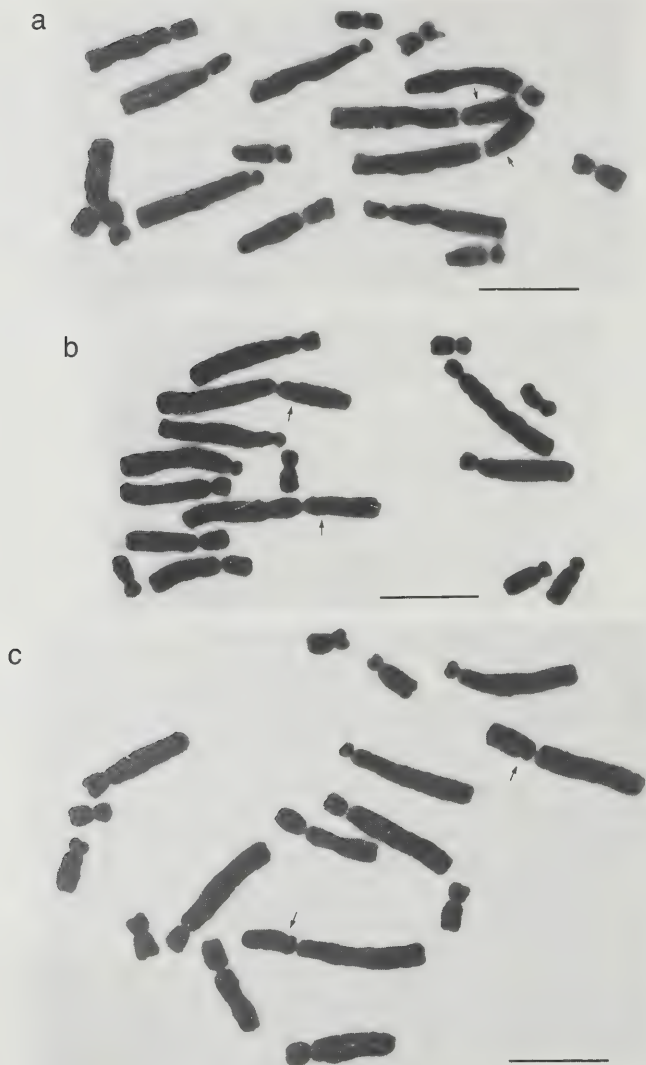


FIG. 3.

a. Mitotic metaphase in *H. humilis* subsp. *hirsutus* [L-1]. Note the secondary constriction in the short-arm of chromosome 1, indicated by arrows; b. Mitotic metaphase in *H. montanus* [L-1]. Note the secondary constriction in the short-arm of chromosome 1, indicated by arrows; c. Mitotic metaphase in *H. sanguineus* [L-1]. Note the secondary constriction in the short-arm of chromosome 1, indicated by arrows.

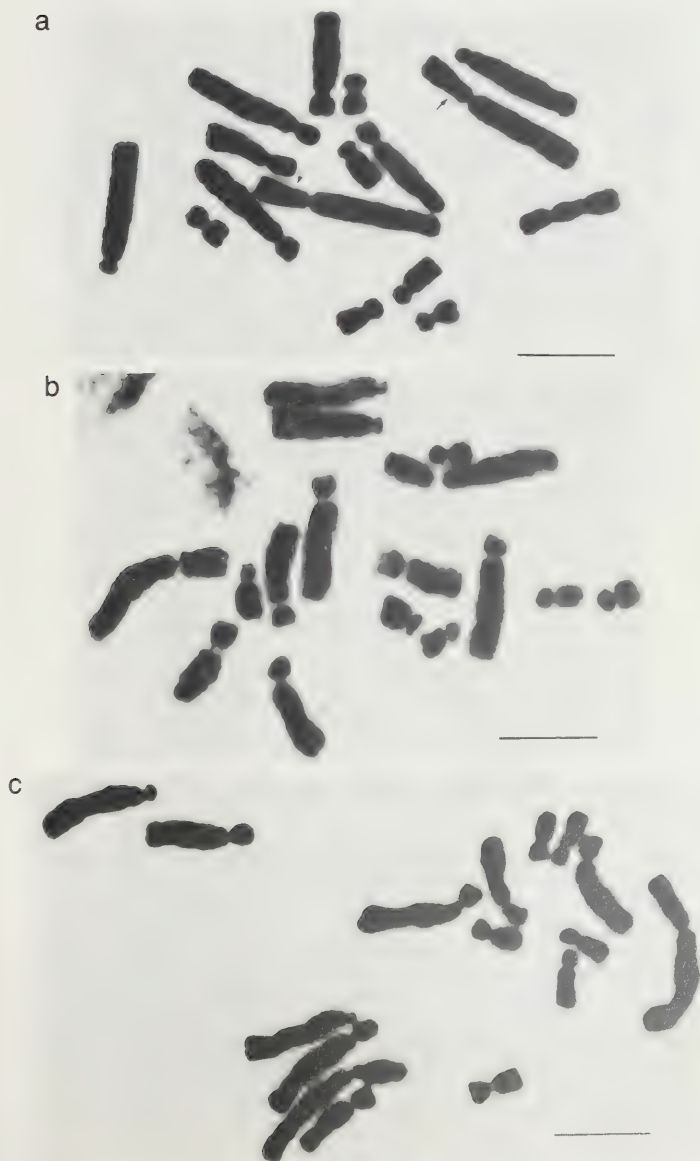


FIG. 4.

a. Mitotic metaphase in *H. pumilio* [L-1]. Note the secondary constriction in the short-arm of chromosome 1, indicated by arrows; b. *H. lanceifolius* [L-1]; c. *H. amarylloides* subsp. *polyanthus* [L-1].

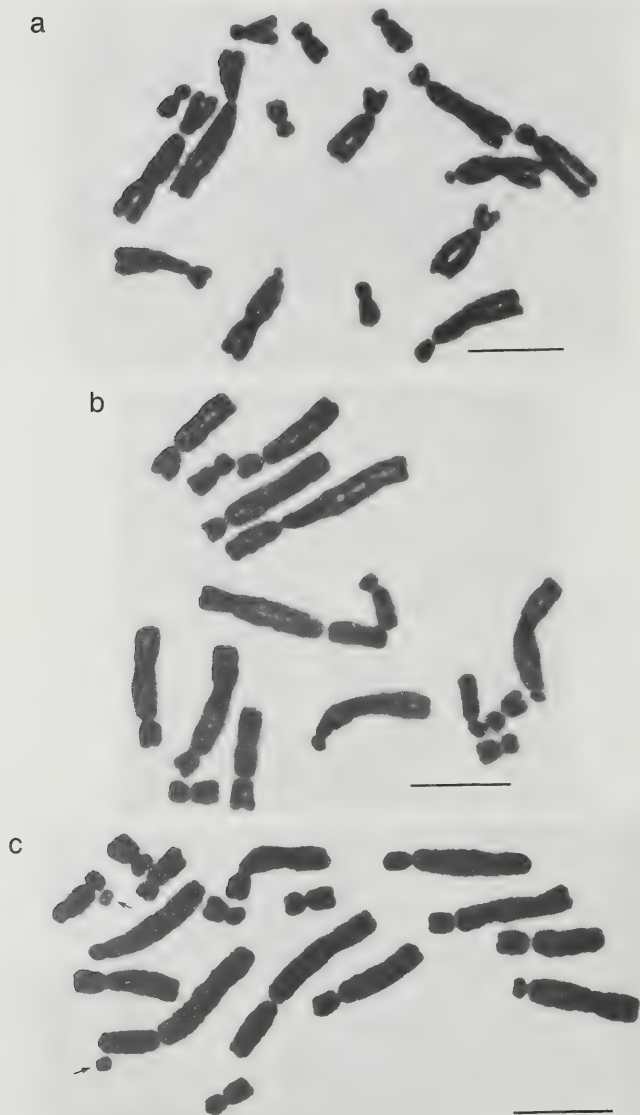


FIG. 5.

a. Mitotic metaphase in *H. amarylloides* subsp. *toximontanus* [L-1]; b. *H. graniticus* [L-1]; c. *H. coccineus* [L-1]. Note telocentric B-chromosomes (arrows).

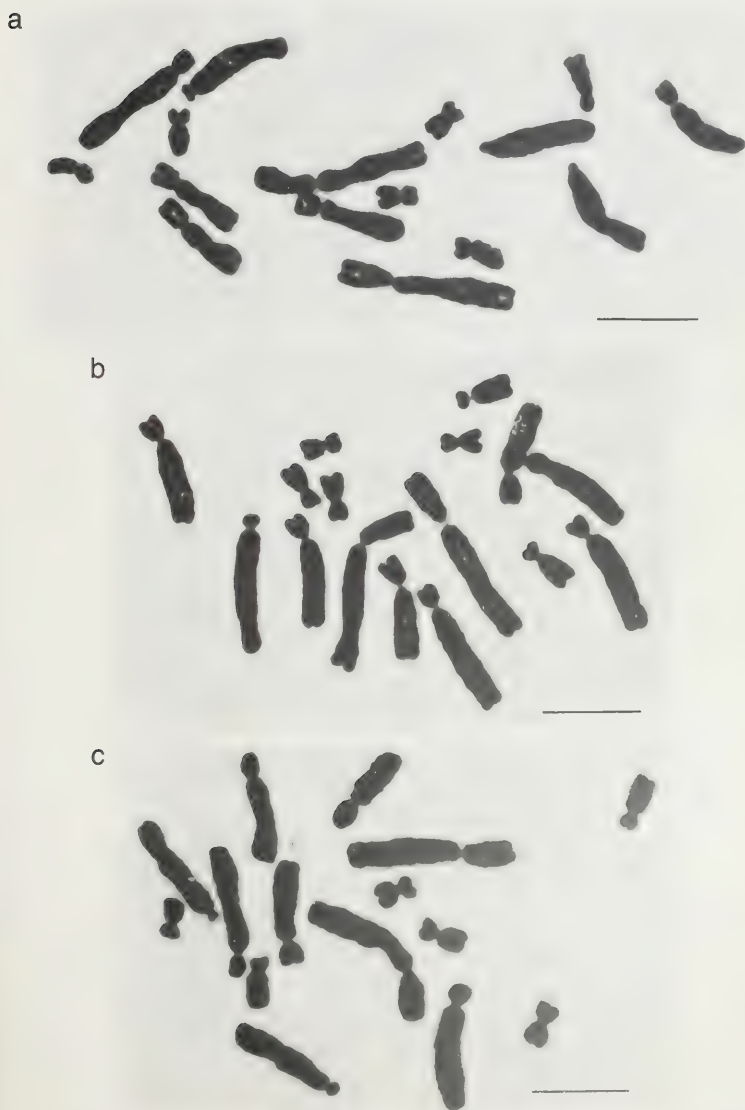


FIG. 6.

a. Mitotic metaphase in *H. unifolius* [L-1]; b. *H. pubescens* subsp. *pubescens* [L-1];
c. *H. pubescens* subsp. *leipoldtii* [L-1].

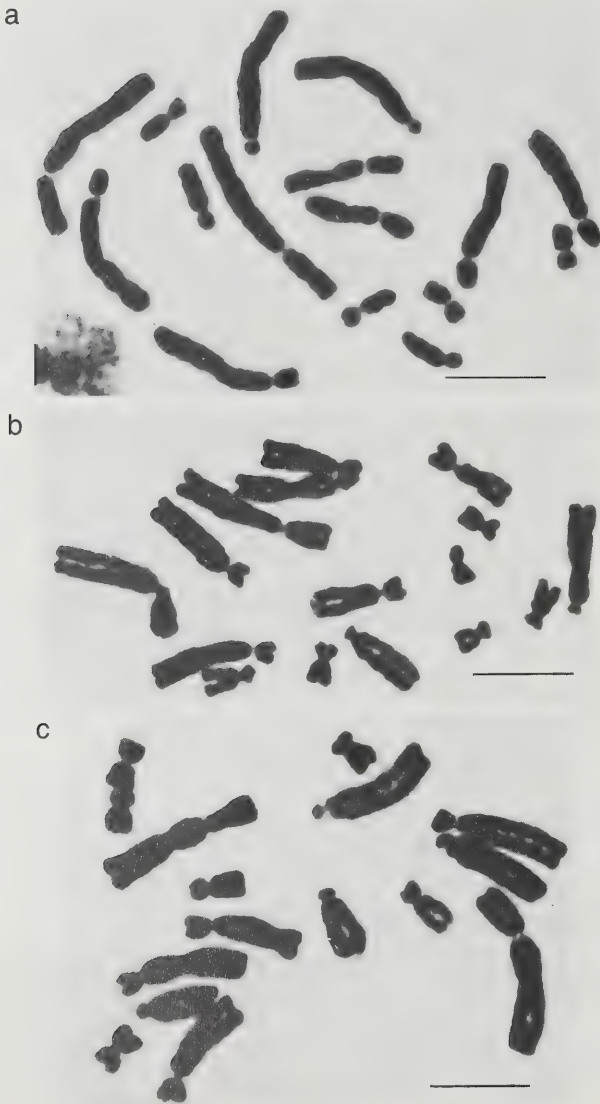


FIG. 7.

a. Mitotic metaphase in the race SM5 of *H. albiflos* [L-1]; b. *H. amarylloides* subsp. *amarylloides* [L-2]; c. *H. pubescens* subsp. *arenicolus* [L-2].



FIG. 8.

a. Mitotic metaphase in the race ST5 of *H. albiflos* [L-3]; b. *H. crispus* [S-1];
c. *H. strigosus* [S-1].

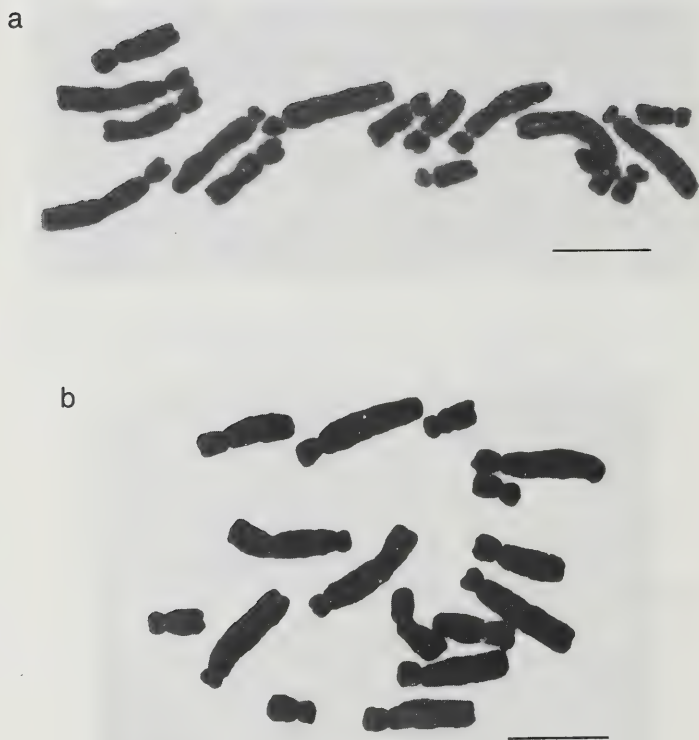


FIG. 9.
a. Mitotic metaphase in *H. barkerae* [S-2]; b. *H. namaquensis* [S-3].

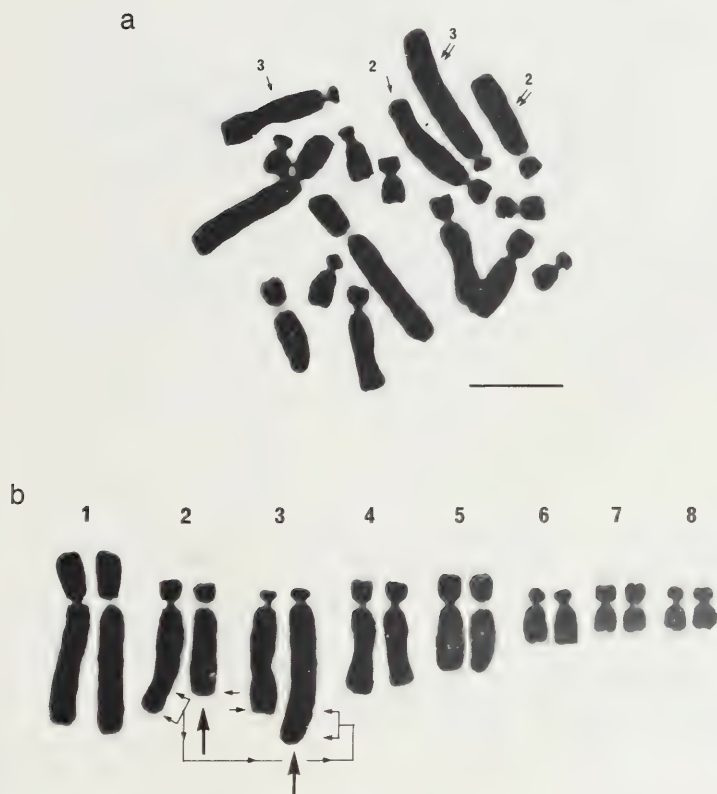


FIG. 10.

a. Mitotic metaphase in the heterozygous plant of *H. canaliculatus* [L-1]. The interchanged and the normal homologues, 2 and 3, are indicated by double and single arrows, respectively. b. The reconstructed diploid complement of the heterozygous plant of *H. canaliculatus* (from Fig. 10a). The interchanged chromosomes are indicated by the large arrows. The assumed points of breakage and reunion are indicated by the small arrows.

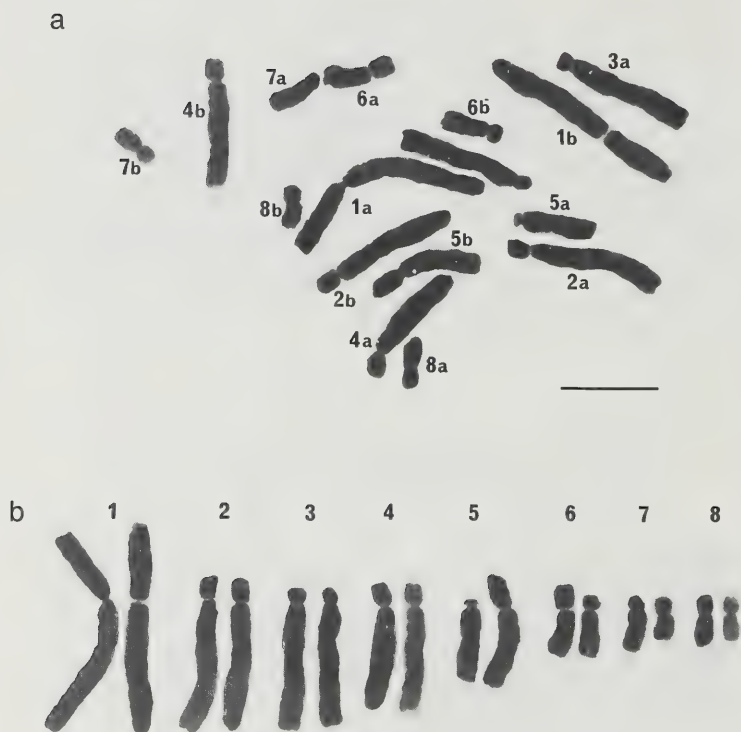


FIG. 11.

a. Mitotic metaphase in the hybrid between the SM5 and the ST5 race of *H. albiflos*. The chromosomes are identified by sequential numbering and by *a* and *b* for race SM5 and ST5, respectively. b. The chromosome complement of the hybrid between the SM5 and the ST5 race of *H. albiflos*, arranged in a linear sequence with the presumed homologous chromosomes paired, SM5 chromosomes left and ST5 chromosomes right.



FIG. 12.

Ideograms of the haploid karyotypes of: a. *H. humilis* subsp. *hirsutus*; b. *H. montanus*; c. *H. sanguineus*; d. *H. canaliculatus* (normal karyotype); e. *H. pumilio*; f. *H. lanceifolius*; g. *H. amarylloides* subsp. *polyanthus*; h. *H. amarylloides* subsp. *toximontanus*; i. *H. graniticus*; j. *H. coccineus*; k. *H. unifolius*; l. *H. pubescens* subsp. *pubescens*; m. *H. pubescens* subsp. *leipoldtii*; n. *H. albiflorus* (race SM5).

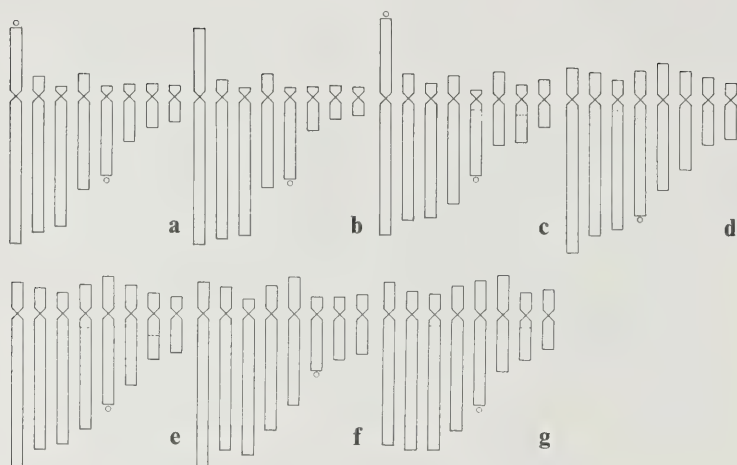


FIG. 13.

Ideograms of the haploid karyotypes of: a. *H. amarylloides* subsp. *amarylloides*, b. *H. pubescens* subsp. *arenicolus*; c. *H. albiflos* (ST5 race); d. *H. crispus*; e. *H. strigosus*; f. *H. barkerae*; g. *H. namaquensis*.

CONCLUSIONS

Overall, the cytological data show that chromosome rearrangements have played an important part in speciation in the genus *Haemanthus*.

In Table 5, the species have been listed along the most simple lines of derivation. The *L*-Group on the left is to be considered the most primitive, although it includes some species with distichous bulbs and elaborate spathe valves which appear to be more advanced.

The *S*-Group, which has certain advanced features, has been placed on the right. The derivation point, the unique event of the translocation between chromosomes 1 and 6 (see Figs 1 and 2) and its fixation as a viable and advantageous homozygote, can be placed at any place along the line of the *L*-Group.

A comparison of the systematic conclusions obtained from the cytological data with those independently derived from conventional taxonomic studies, demonstrates good, although not complete, agreement.

It illustrates the value of the two different approaches to the problems of evolution and speciation by reciprocally highlighting and integrating the question of the concept of species as 1) groups of interbreeding individuals

and their progeny undergoing constant selective pressure, or 2) groups of morphologically intergrading individuals spread over diverse environmental situations.

The findings of the chromosome analysis confirm the hypothesis that differences between species arise, or rather begin as, differences within species.

They make clear that chromosome rearrangements such as interchanges and inversions are of frequent occurrence in *Haemanthus*.

Those rearrangements which have become established as homozygotes have led to the creation of new karyotypes. Through degrees of genetic isolation and the presence of positive selection for certain characters, this in turn has led to the formation of new species.

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A NEW SPECIES OF *DISA* (ORCHIDACEAE)

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ABSTRACT

Disa clavicornis Linder, sp. nov. is described from Mt. Anderson near Lydenburg, Transvaal.

UITTREKSEL

Disa clavicornis Linder, sp. nov. vanaf Mt. Anderson naby Lydenburg, Transvaal word beskryf.

Key words: *Disa*, sp. nov., Orchidaceae, eastern Transvaal.

Disa clavicornis Linder, sp. nov., a speciebus quas Linder ad *Disae* sect. *Hircornes* ascripsit calcaribus ascendentibus clavatis diversa.

Type: TRANSVAAL—2530 (Lydenburg): Long Tom Pass, Mt. Anderson (-BA), *Lavranos* 9358 (PRE, holo.).

Terrestrial herb, 400 mm tall. *Leaves* cauline, 100 mm long at the base, the lower half sheathing, the upper half narrowly ovate, acute, semi-erect, subimbricate, grading apically into the floral bracts. *Inflorescence* cylindrical, dense, 150 mm long, 20 mm in diameter. *Bracts* as tall as the flowers, or at the base overtopping the flowers, very acute to acuminate, lanceolate. *Flowers* salmon-coloured, facing downwards. *Lateral sepals* narrowly oblong, $6 \times 2,8$ mm, spreading, subacute. *Dorsal sepal* galeate, galea 5.5 mm tall, 4 mm deep, spur ascending to erect, slender cylindrical, 7 mm long, apex strongly clavate. Petals borne erect, narrowly lorate, 6×1 mm, acute. *Lip* narrowly lorate, $4,5 \times 0,5$ mm, acute. *Anther* reflexed, 1.5 mm long. *Rostellum* lateral arms erect, canaliculate, 0.5 mm tall, stigma shortly pedicellate in front of the rostellum, tripulvinate. *Pollen* aggregated into massulae, surface colliculate to rugulate, with a finer rugulate-gemmate ornamentation (Figs 1 and 2).

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FIG. 1

Disa clavicornis. a, whole plant, $\times 1$; b, flower, $\times 5$; c, lateral sepal, $\times 8$; d, column, with lip and one petal still in position, $\times 8$. From Lavranos 9358.

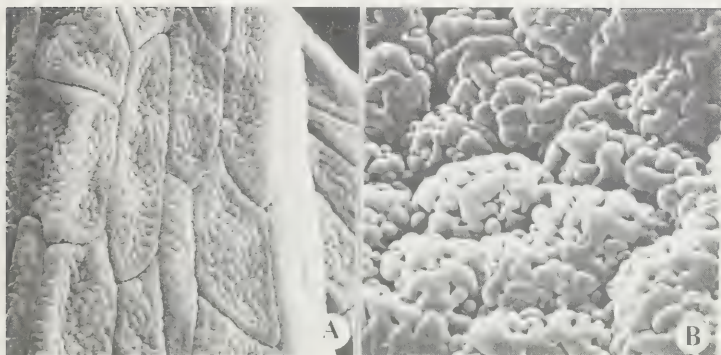


FIG. 2.

Pollen of *D. clavicornis*. A. massulae, $\times 1\ 000$; B. detail of pollen surface, $\times 10\ 000$.

Known from only one collection from the eastern Transvaal, from wet ground at 2 000 m. Flowering in February.

This species belongs to sect. *Hircicornes* Kraenzl., and is related to *D. rhodantha* Schltr. However, the clavate, ascending to erect, spurs are distinct.

The Mt. Anderson area appears to be very rich in endemic terrestrial orchids, as this is the fourth new species which I have described from there. No doubt further collecting will result in more interesting taxa being found.

BOOK REVIEWS

PALYNOLOGISCHE UNTERSUCHUNGEN AN CAPRIFOLIACEAE: 1. SAMBUCEAE, VIBRURNEAE UND DIERVILLEAE, by Evelyn Böhnke-Gütlein and Focko Weberling, with pp. 63. Wiesbaden: Franz Steiner Verlag GmbH. (Tropische und subtropische Pflanzenwelt 34, 1981). DM 24,40.

In recent years the study of pollen morphology has become an important tool in plant taxonomy. The fine structure and sculpture of the sporoderm can give very valuable information on the systematic relationships of plant taxa. The study of Böhnke-Gütlein and Weberling on the Caprifoliaceae is a very good example of this modern approach to plant taxonomy.

In this technical publication of 63 pages the authors give an account of their studies of the pollen morphology of the Sambuceae, Viburneae and Diervilleae. The pollen characteristics of 49 species of these tribes are uniformly and systematically described using the terminology of Straka. Only herbarium material was used for these studies. The pollen samples were boiled in 10 % KOH and thereafter treated with the acetolysis method of Erdtman.

Light- and scanning electronmicroscopy were used for the pollen morphological studies of the exine, the latter including 0.15 μ sections cut with a freezing microtome. The SEM material was coated with Gold and Palladium applying the Critical-Point-Drying technique. The descriptions of the various pollen types are illustrated with SEM micrographs of extremely good quality. It is a pity, however, that light-micrographs are not included and also that no transmission electronmicroscope studies were carried out at this level of pollen taxonomic studies.

The pollen of the highly developed Caprifoliaceae belongs to the trizonocolporate, tetrazonocolporate and trizonopororate types. The exine structures are very clearly described with the aid of an excellent scheme showing the transitions between tectate and intectate forms. According to Walker and Doyle, on the basis of their studies of the Ranales, the main evolutionary trend in the exine of angiosperms seems to proceed from tectate-imperforate to tectate-perforate and semitectate pollen to intectate types. In some angiosperms, however, the reverse development occurs. This is borne out by the study of Böhnke-Gütlein and Weberling of the highly developed Caprifoliaceae.

This softcover publication is very well produced. The text is lucid and well written and an English summary is provided. The bibliography includes references to foremost palynologists in this field, although little reference is made to the classical works of Erdtman and Faegri and Iversen.

The publication with its excellent illustrations will be of great use to those engaged in studies of recent or fossil pollen in systematic or pollen analytical investigations.

J. A. COETZEE

MOLECULAR BIOLOGY OF THE CELL, by B. Alberts, D. Bray, J. Lewis, M. Raaf, K. Roberts and J. D. Watson, with pp. xxxix + 1145. New York, London: Garland Publishing, 1983. US \$23,00. ISBN 0 8240 7283 9.

It is not every book that can boast a table of contents consisting of 20 pages. But then, *Molecular Biology of the Cell* is not just any book. It is a compendium first and foremost of the cytology and molecular biology of eucaryotic cells and, last but not least, of their behaviour in multicellular communities of tissues, organs and organisms. The book deals mainly with the animal cell, although one chapter and parts of others are set aside for plant cells and their specific processes.

Briefly, the book comprises three sections. The first considers the evolution of the cell; its micromolecules and biosynthetic activities; the structure, shape and information-yielding qualities of its macromolecules; and the techniques used in studying it. The second deals with the cell's molecular organisation; with its nucleus, organelles and membranous systems, its cytoskeleton, energy conversions, growth and division; and with intercellular communication. The third section is devoted to cells in and as tissues and multicellular organisms; the maintenance of tissues; immune and nervous systems; and, as indicated above, to special features of plant cells.

Although a softcover book, the quality of reproduction of the photographs is good and the explanatory figures are excellently drawn. Clearly, this book is intended for the student in biology and medicine who already has completed a course in introductory biology, but I am convinced that also postgraduates, lecturers and professional scientists will find it a guide of almost encyclopedic proportion. Coverage is broad but detailed, with adequate general and cited references as well as a useful 33-page index.

As compared with most other scientific books today, *Molecular Biology of the Cell* at US \$23,00 is not only ridiculously inexpensive, but an essential acquisition for the biologist's personal library.

CHRIS H. BORNMAN

THE CHANGING CLIMATE: RESPONSES OF THE NATURAL FLORA AND FAUNA, by Michael J. Ford, with pp. 192 + 50 figures. London: George Allen and Unwin, 1982. £13,95, approx. US\$ 27,50. ISBN 004 574017 8.

As mentioned by the author, this book is a first attempt to present a comprehensive account of the ways in which plants and animals of natural habitats react to changing climates. In this connection the considerable past climatic changes, their effects and possible causes are briefly discussed. Special attention is focused on the various types of evidence from important disciplines such as palynology, deep sea sediments and oxygen isotope ratios. Historical records such as those from dendrochronological studies are referred to. For an understanding of these past events the mechanisms for climatic change and present climatic systems are discussed at length.

The author has succeeded in presenting in eleven subdivided chapters a concise synthesis of many aspects of this vast subject in such an interesting way that it should inspire further research in many related fields. A wide range of examples, especially from historical times, is used to clearly indicate the interactions between changing climate and organisms and their habitat. The levels of response of individuals,

species and whole ecosystems are discussed and it is emphasised that temperature is the basic factor affecting and driving climatic systems and hence life processes. With regard to the latter, metabolic processes which are temperature dependent, determine tolerance limits of species. In this regard, stenotopic organisms are extremely vulnerable to climatic change. These aspects are, for instance, very important in marginal climatic habitats such as at the tree line on high altitudinal mountains or in high northern latitudes. The length of the growing season in these areas is very important for survival and in this regard the ranges of expansion and contraction of biomes with respective amelioration or deterioration of climate are discussed. In this connection it is emphasised that where habitats in such areas shrink as a result of anthropogenic activities, final extinction of species may result.

Many facets of the close interaction between climate and organisms are elaborated on, such as parasite-pathogen-host relationships, long distance dispersal of propagules and colonisation, bird migration, phenology and competition in communities. With regard to the latter, the considerations are relevant to the present heated controversies among ecologists about the theories of competition.

For this survey of basic information, reference has been made to numerous articles by leading scientists from many different relevant disciplines. Important attention has been drawn to many aspects of relationships between climate and biota which should be considered when dealing with present and past ecosystems. For this reason this book is recommended as a valuable reference for ecologists, palaeoecologists, palynologists, biogeographers, conservationists and climatologists.

J. A. COETZEE

DAS HORMONSYSTEM DER PFLANZEN, by K. Dörffling, with pp. xviii + 236. Stuttgart, New York: Thieme, 1982. DM 29.80. ISBN 3 13 618501 3.

George Thieme Verlag of Stuttgart in the German Federal Republic publishes a softcover series designated BIO. This series, "Die blaue Bücher" has become a characteristic and popular feature of the university bookstore and a few of the most successful titles published in the handy 120 × 190 mm format include: *Allgemeine Botanik* (Nultsch), *Allgemeine Mikrobiologie* (Schlegel), *Genetik* (Kalmus) and *Das Wesen der Biochemie* (Baldwin). Now there has appeared *Das Hormonsystem der Pflanzen* by hormone physiologist Karl Dörffling of the University of Hamburg, author of many outstanding papers not least of which are the regular review contributions to *Progress in Botany*.

Although there are many excellent textbooks of general botany and plant physiology in the German language, the last monograph on plant hormones was published 30 years ago. In this respect the book under review was overdue in Germany. However, from the point of view of understanding the complexity of hormonal action and interaction, a treatment bold enough to break with the traditional linking of a specific physiological process with only one specific hormone, was very long overdue. The various hypotheses regarding the physiological function of the hormones are given critical consideration.

The book contains 18 chapters, of which five on the auxins, gibberellins, cytokinins, abscisic acid and ethylene make up slightly more than half the volume. Each hormone group is considered in terms of its discovery, structure and mode of action. In addition there is information on isolation, characterisation and special effects. There are chapters dealing with flowering, sexual hormones, interaction, dormancy,

and senescence and abscission. One chapter treats applied aspects and growth regulation, and naturally also includes reference to growth regulators other than hormones.

The author has made liberal use of illustrations and has included results in the form of graphs, histograms and line drawings from some of the best published papers. In addition to a list of cited references, each chapter is concluded with suggested further readings of monographs, review articles and chapters from treatises. Although based on lectures to students in botany, this little book is recommended reading for anyone seriously interested in plant growth substances. In fact, when read in conjunction with the controversial and unconventional views of A. J. Trewavas (for example: How do plant growth substances work?—*Plant, Cell and Environment* 4: 203–228, 1981, and, Growth substance sensitivity: the limiting factor in plant development—*Physiol. Plant.* 55: 60–72, 1982), Dörffling's treatment of hormones in plants brings a refreshing perspective to an aspect of plant physiology in which, in the past, compartmentalised thinking probably has been responsible for the concept that hormones act in compartmentalised fashion.

CHRIS H. BORNMAN

A REVISION OF *DIASCIA* SECTION *RACEMOSAE*

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ABSTRACT

The two sections of *Diascia* (Scrophulariaceae—Hemimerideae) are re-defined attaching importance to the position of the two translucent yellow "windows", which, in sect. *Diascia*, are on the lateral lobes at the mouths of the pouches or spurs, while in sect. *Racemosae* they are on the two upper lobes. A key is given to the 26 species in sect. *Racemosae* and they are fully described; most of them are also illustrated. The affinities of the genus, its distribution, the inter-relationships of the species in sect. *Racemosae* and their floral biology are briefly discussed. An appendix deals with *Alonsoa peduncularis*, the one South African species of this American genus.

UITTREKSEL

'N HERSIENING VAN *DIASCIA* SEKSIE *RACEMOSAE*

Die twee seksies *Diascia* (Scrophulariaceae—Hemimerideae) word herdefinieer in terme van die plasing van die twee deursigtige geel "vensters" wat in die seksie *Diascia* op die laterale lobbe by die opening van die sakkies of spore is terwyl by die seksie *Racemosae* hulle op die twee boonste lobbe is. 'n Sleutel word vir die 26 soorte in seksie *Racemosae* gegee en hulle word ten volle beskryf; die meeste word ook geïllustreer. Die affiniteite van die genus, sy verspreiding en die verwantskappe van die spesies in die seksie *Racemosae* en hulle floristiese biologie word kortliks bespreek. In 'n bylaag word *Alonsoa peduncularis*, die enigste Suid-Afrikaanse spesies van hierdie Amerikaanse genus, behandel.

Key words: *Diascia* sect. *Racemosae*, Scrophulariaceae, *Alonsoa*, floral biology, pollen biology.

INTRODUCTION

Diascia is one of the genera of South African Scrophulariaceae (*Zaluzianskya* and *Manulea* are others) that have mostly perennial species in the eastern region, annual ones in the Cape; but there are other differences to be considered than that of habit alone. We are primarily concerned here

with a revision of the eastern perennial species, but the taxonomic subdivision of the genus forces us to include a group of Cape annuals as well.

Many species of *Diascia* have corollas with two spurs, and although full generic descriptions (Wettstein, 1894; Hiern, 1904; Dyer, 1975) rightly refer to pits, pouches or spurs, the spurs have attracted most attention. J. D. Hooker wrote (1871) "The pretty Cape genus *Diascia*, which, like *Satyrion* among Cape orchids, is remarkable for its two spurs". Chittenden (1951) gives the derivation of the name as "*di*, two, *askos*, sac, referring to the two spurs". In fact, spurred species were not known when the genus received its name, which refers to the two sacs or pouches found in the original species, *D. bergiana*. The spurs have diverted attention from the two translucent yellow patches that mark the position of the pouches in *D. bergiana*. These patches are entirely ignored in the generic descriptions quoted above, though they are mentioned in a few of Hiern's specific descriptions. We here refer to these patches as windows, because of their translucence.

Nearly all the Cape annuals have two lateral windows closely associated with the openings to the pouches or spurs. In the mostly perennial species from the eastern region there is a single (or slightly double) window in the middle of the upper lip below the sinus. In a few related annuals there are two distinct windows, but they are always on the upper lip of the corolla and in no way associated with the mouths of the spurs.

The central posterior window is not simply a yellow mark on the corolla. It is of diverse form and may be nearly flat, or pouched, or drawn out into a short hollow cone. It differs from the rest of the corolla structurally, the cells of the inner epidermis being strongly mamillate and full of dense contents (see under FLORAL BIOLOGY). Recognition of the importance of these windows permits a re-assessment of the infrageneric classification.

HISTORY AND SUBDIVISION OF THE GENUS

Although we are only revising part of the genus in detail, it is necessary to review the history and subdivision of the whole in order to define our field.

Diascia was described by Link & Otto (1820) for a single species, *D. bergiana*, which was grown at Berlin from seed sent home by the pharmacist and naturalist C. H. Bergius, who collected in the Cape from his arrival in 1815 to his premature death in 1818. *D. bergiana* is one of the Cape annuals: the corolla has two small yellow pouches situated at the base of the lateral lobes.

It was soon recognised that other plants already described belonged to the same genus. Sprengel (1825) added *D. thunbergiana* Spreng. [i.e. *D. longicornis* (Thunb.) Druce, based on *Antirrhinum longicorne* Thunb.], *D. macrophylla* (Thunb.) Spreng. (based on *Hemimeris macrophylla*

Thunb.), and *D. montana* (L.f.) Spreng. [which is known today as *Hemimeris racemosa* (Houtt.) Merrill]. As the nomenclatural confusion between *Hemimeris* and *Diascia* primarily concerns the Cape species we need not go into it in detail here. It is sufficient to say that *Hemimeris* L.f. (1781) is now *nomen conservandum* with *H. montana* L.f. [= *H. racemosa* (Houtt.) Merrill] as its type; therefore *Diascia* is no longer threatened by the earlier *Hemimeris* L. (1760) based on the plant we now know as *Diascia capensis* (L.) Britten.

Bentham (1836a) made the first comprehensive study of *Diascia* recognising 17 species. He arranged them in three unranked groups **Brachycarpae*, ***Leptocarpae* and ****Racemosae*. The type species, *D. bergiana*, belongs to *Leptocarpae*. Wettstein (1894) combined the first two groups as sect. *Axillares* (which in terms of the modern Code becomes sect. *Diascia*) and recognised the third as sect. *Racemosae* (Benth.) Wettst. (if we give it the authorities now enjoined by Art. 35.2). Hiern made no formal subdivision of the genus; his arrangement of the species nearly reflects Bentham's although, as will be seen, the five anomalous species at the beginning (all unknown to Bentham) need redistribution.

The primary characters used by Bentham, and following him by Wettstein, were drawn from the inflorescence, with a secondary character from the leaves. Thus sect. *Diascia* has axillary or subfasciculate flowers and leaves narrowed to the base; sect. *Racemosae* has a terminal raceme of flowers and leaves broader and more or less truncate at the base. It is now possible to add to the characters of sect. *Diascia* "windows two, at base of lateral corolla lobes associated with openings to pouches or spurs, very rarely (*D. engleri* Diels) absent"; and to that of sect. *Racemosae* "window usually central at base of upper lip, more rarely split into two contiguous parts, or two entirely separate windows, but these always on the upper corolla lobes and not associated with the openings to the spurs". It is significant that the few species in sect. *Racemosae* with two separated windows are ones that in habit (they are annuals) and in geographical distribution come nearest to the Cape sect. *Diascia*.

In Hiern's account in *Flora Capensis* (1904) species no. 6–22 belong to sect. *Diascia*; no. 23 has been transferred to *Diclis* (Hilliard & Burt, 1979: 313); no. 26–47 belong to sect. *Racemosae* except no. 45, *D. denticulata* Benth., which has been transferred to *Nemesia*. It is species no. 1–5 and 24–25 that need reconsideration:

1. *D. engleri* Diels—this is anomalous in its almost regular flower and in the corolla apparently lacking spurs, pouches or windows (cf. Vogel, 1974, fig. 13H). The rosulate habit and long one-flowered peduncles clearly mark it as belonging to sect. *Diascia*.
2. *D. monasca* Hiern—this is described as probably perennial and has

- a broad yellow pouch at the base of the upper lip. It belongs to sect. *Racemosae* and is treated below under *D. patens*.
3. *D. minutiflora* Hiern—the vegetative characters are clearly those of sect. *Diascia*.
 4. *D. tysonii* Hiern—this is indistinguishable from *D. alonsooides* Benth. (sect. *Racemosae*).
 5. *D. scullyi* Hiern = *Hemimeris racemosa* (Houtt.) Merrill (syn. *H. montana* L.f.).
 24. *D. dissecta* Hiern—this is very close to, and perhaps not distinct from, *D. unilabiata*.
 25. *D. unilabiata* (Thunb.) Benth. This has its few flowers arranged racemously at the top of the unbranched stem: but the two yellow windows are clearly associated with the lateral pouches (see Rice & Compton, 1951 t. 116), and the pinnatifid leaves suggest it is to be referred to sect. *Diascia*, though the curious corolla form and the racemose flowers mark it off rather sharply from the rest of the section.

AFFINITIES OF *DIASCIA*

In 1835 Bentham established the tribe Hemimerideae for the South African genera *Hemimeris* L. (incl. *Diascia*) and *Nemesia* Vent. and the South American *Angelonia* Humb. & Bonpl. and *Thylacantha* Nees & Mart. In the next year (Bentham, 1836a), he recognised *Diascia* as distinct from *Hemimeris* and added the genus *Diclis* Benth. Hemimerideae were essentially distinguished from Antirrhineae by the valvular, not porose, dehiscence of the capsule. *Colpias* Benth. was at first referred to Digitaleae (Bentham, 1836b), but was transferred to Hemimerideae when Bentham again revised the group for De Candolle's *Prodromus* (Bentham, 1846).

In 1835 Bentham had placed the South American *Alonsoa* Ruiz & Pavon in Verbasceae, but in *Genera Plantarum* (1876) he moved it into Hemimerideae alongside *Angelonia*, which now included *Thylacantha*. In 1842 Kunze had described a South African plant as a distinct genus *Schistanthe*, but Bentham (1876) justifiably reduced this to *Alonsoa* (see APPENDIX).

Wettstein (1894) altered Bentham's concept of Hemimerideae by transferring *Nemesia*, *Diclis* and *Colpias* to Antirrhineae. The character on which he effected this shift was the presence of a corolla tube in Antirrhineae. This is obviously using tube in the precise sense of tubular, not, as is so often done, merely as a term for the lower gamopetalous part of the corolla. In the Hemimerideae in Wettstein's sense this gamopetalous part may be bowl-shaped and it may also be invaginated at the base, as in many *Diascia*; but it does not form a simple tube. However, the difference is not fundamental.

In *Ornithoboea* C.B. Cl. (Gesneriaceae) the species show a range from a straight tube to a much abbreviated almost globular one (see Burt, 1958). It would be foolish to rely too much on analogy from another family, but even in *Nemesia* itself the range of tube-form is considerable. This character is not sufficiently clear-cut and decisive to over-rule Bentham's observation of the difference in fruit-form. Furthermore, fruit-form is backed up by the form of the androecium, for both in *Nemesia* and in *Diclis*, as in *Diascia*, the filaments of the anterior stamens curl round the base of those of the posterior ones, and the anterior anthers take up a posterior position. This does not happen in Antirrhineae. Thus there is every reason to believe that *Diascia* and *Nemesia* are quite closely allied.

Of *Nemesia* Bentham (1836a) wrote "The structure of the sexual organs is the same as in *Diascia*, but the two concavities of the corolla are confluent into one pouch or spur, sometimes retuse or slightly emarginate at the extremity . . .". Bentham was not, of course, writing with an evolutionary concept in mind, but the possibility that the single spur or pouch of *Nemesia* represents a confluence of the two found in *Diascia* is suggestive. In *Nemesia*, for example in *N. strumosa* Benth. (cf. Bot. Mag. tab. 7272), it can certainly appear to be a double structure with a well-marked median groove; though whether this groove has any phyletic significance or is the mere result of its being a median structure in a bilaterally symmetrical flower is not yet clear.

There is then a group of 5 genera in South Africa, *Colpias*, *Diascia*, *Diclis*, *Hemimeris* and *Nemesia*, that can be accepted as fairly close allies. Where else do their affinities lie? Bentham associated with them the South American *Angelonia* and, later, *Alonsoa*. Whereas in *Diascia* the elaboration of the corolla takes the form of spurs, pouches and windows, in *Angelonia* the diversification of the palate is into a bowl-shaped structure and the rim between this bowl and the anterior lobe of the corolla may produce curious comb- or horn-like outgrowths. In *Alonsoa* the corolla is resupinate, the enlarged lower lip (morphological) thus standing above the stamens as a sort of flag. A somewhat similar effect, without resupination, appears to be produced by the enlargement of the upper lip in *D. unilabiata* (Thunb.) Spreng., belonging to sect. *Diascia*, and to a lesser extent in *D. purpurea* in sect. *Racemosae*. Neither *Angelonia* nor *Alonsoa* show the twisting of the anterior filaments characteristic of *Diascia* and *Nemesia*. The fruit of South American *Alonsoa* is very similar to that of the large-fruited species of *Diascia*, while that of the South African species resembles that of the smaller-fruited species of *Diascia*. The seeds of *Alonsoa* are however quite different: oblong and grooved, not nearly spherical and heavily ornamented as in *Diascia*.

The little-known South African *Alonsoa penduncularis* (see APPENDIX) is

very important in providing a morphological link between the rest of the genus and *Diascia*. The critical feature is that there are two small yellow pouches at the base of the lateral corolla lobes. These immediately recall the pouches found in *Diascia*: they are not found in the South American species of *Alonsoa*. *Alonsoa peduncularis* is in other respects typical of its genus and well differentiated from *Diascia*, particularly in its resupinate corolla split to the base on one side, in the filaments not being twisted at the base and in its oblong grooved seeds.

The available evidence confirms the unity of Hemimerideae.

PHYTOGEOGRAPHY

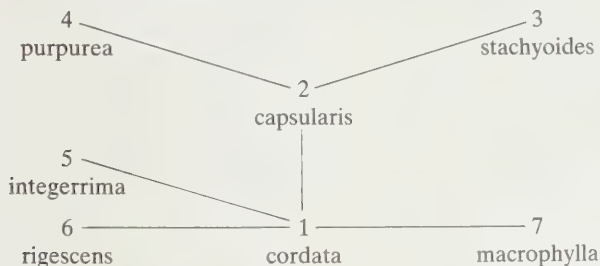
Links between the floras of Africa and America have long excited the interest of phytogeographers. Recently Stearn (1971) has discussed certain aspects of the data, with particular regard to stages leading up to complete discontinuity between America and Madagascar. Thorne (1973) has surveyed the problem in general and has listed Hemimerideae as one of the higher groups concerned, a position emphasised by the present recognition that *Alonsoa* is truly an amphi-atlantic genus. Despite much new data introduced by these authors, the discussion is still too narrowly based. Until the patterns of affinities in the wide pantropical genera and families have been assessed there can be little further progress. Here we only wish to draw attention to two additional examples in Scrophulariaceae: *Melasma* Berg. has three species in southern and eastern Africa and three in central and southern America (Melchior, 1940); *Alectra* Thunb., in which sect. *Alectra* is well-represented in Africa and ranges both eastwards through to East Asia and westwards, with 2 species in South America (Melchior, 1941). These two genera belong to the tribe "Gerardieae" (Wettstein, 1894—more properly Buchnereae), which within the classification of Scrophulariaceae is far removed from Hemimerideae. The Scrophulariaceae links contrast with the situation in the allied family Gesneriaceae where African representatives have wholly Asiatic affinities. Both sides of the balance sheet must be assessed.

Within southern Africa the distribution of *Diascia* sect. *Racemosae* invites comparison with that of other Scrophulariaceae such as *Zaluzianskya* sect. *Zaluzianskya* and *Glumicalyx*. It agrees with *Zaluzianskya* sect. *Zaluzianskya* in being primarily a group of the summer rainfall area, with a strong montane element: but both groups have typical members, some of them annual, at lower altitudes and further south and west (*Zaluzianskya capensis* reaches the Cape Peninsula, *Diascia dielsiana* the Riversdale district) as well as a group of specialised annuals stretching across to the western Cape. However, *Zaluzianskya* sect. *Zaluzianskya* extends northwards

through the Transvaal to Inyanga in Zimbabwe, whereas *Diascia* sect. *Racemosae* stops on Platberg near Harrismith, the last upstanding basalt mass north of the main Natal Drakensberg. In this it resembles *Glumicalyx* (Hilliard & Burtt, 1977), which also has its most northerly station on Platberg, but that genus is wholly montane and ranges south only as far as the Cape Witteberg (Lady Grey district).

INTERRELATIONSHIP OF SPECIES

Within sect. *Racemosae* we recognise 26 species, which may be grouped in a number of small alliances. In the text these can only be considered in a linear order, so we give a small diagram to show our views, very speculative, of possible relationships. It may reasonably be argued that such species as *D. purpurea* or *D. lilacina* are at the ends of their respective lines of development. However, it is clear that we are dealing with a genus of considerable diversity but with relatively little evolutionary progression. As usual, some species are very closely allied, others are relatively isolated and bear witness to the many species that must now have become extinct.



Group 1, *D. cordata* group, includes also *D. racemulosa*, *D. ramosa* and *D. mollis*. All have diffuse stems, racemes that are often very lax, almost flagelliform, and long pedicels. In *D. cordata* and *D. mollis* the stamens project straight forward; in *D. racemulosa* they stand erect and the palate is raised into a median keel, which is clad in dark sessile glands; in *D. ramosa* two stamens are erect, two project forwards. The window, at least in *D. cordata* and *D. ramosa*, is double, composed of two almost contiguous yellow patches each forming a little pouch. The range is from the Boschberg near Somerset East through Transkei to southern Natal, with *D. cordata* itself standing a little apart, being found on the slopes of the Drakensberg and its outliers at 1 500–2 440 m.

In this group *D. cordata* and, probably, *D. ramosa*, are perennials, but *D. racemulosa* and *D. mollis* are annuals. It is the double yellow patch and

the occurrence of annuals that lead us to suggest that from this group through group 7 (which are all annuals) the Cape species of sect. *Diascia* are related to sect. *Racemosae*. The splitting of the genus into these two sections seems to be fundamental and we therefore place group 1 at the base of our diagram of relationships within sect. *Racemosae*.

Group 2 consists of *D. capsularis*, widespread from the eastern Cape to the Orange Free State (but absent from Transkei, Natal and Lesotho), and four more restricted montane species, *D. barberae*, *D. tugelensis*, *D. vigilis* and *Diascia* sp. nov. (no. 9). In terms of *Diascia* sect. *Racemosae* this group is the most difficult to characterise, having all the features of the section and no particular distinguishing ones.

Group 3 consists of *D. stachyoides*, *D. stricta*, *D. fetcaniensis* and *D. lilacina*. The first three species are very closely allied to the previous group: the distinguishing character is that the window instead of being concave from the inside, forming a small pouch, is more strongly developed into a distinct hollow cone. The plants also are generally more hairy than in the group 2. The fourth species, *D. lilacina*, stands apart at the end of this line of development. Its peculiar features are its very small flowers coloured lilac, not pink nor red, complete absence of lateral spurs, and the grey-green pollen of all four anthers; the conical window is well-developed.

Group 4 (*D. anastrepta*, *D. megathura*, *D. purpurea*) may be regarded as a separate development from group 2 characterised by large flowers with the anthers of the anterior stamens sterile or producing just a little yellow pollen. These stamens stand erect. The posterior ones lie on the floor of the palate and produce green pollen (see further under FLORAL BIOLOGY). In *D. purpurea* there is a unique development of the corolla: the upper lip is enlarged and overarches the rest of the flower: the lower lip is much reduced.

Group 5 comprises *D. integerrima*, *D. dielsiana* and *D. patens*. These are essentially eastern and southern Cape plants, although *D. integerrima* ranges into Natal and Lesotho. The distinguishing feature of *D. integerrima* is that the palate is strongly ridged and covered with dark glands. This condition has already been noted in *D. racemulosa* of group 1 and we assume that this is a true mark of affinity: but *D. racemulosa* has the straggly habit, long pedicels, broad leaves and wide-spreading spurs of *D. cordata*. *Diascia integerrima* and its allies have a more twiggy habit, narrow leaves, and stiff erect inflorescences of shortly pedicellate flowers. *D. integerrima* grows in exposed situations, often on cliffs, whereas *D. cordata* and its allies are found in damper places—thickets, forest margins, rough streambank grassland. Nothing is known of the ecology of *D. patens* and *D. dielsiana*.

Group 6 comprises only two species, *D. rigescens* and *D. personata*. These are much more robust, erect plants very similar to one another vegetatively. They are, however, remarkably different florally. *Diascia rigescens*

has a ridged palate covered with a dense crest of bright yellow stalked glands: these are unique in the genus. *Diascia personata* has a broad swollen palate that effectively closes the mouth of the corolla, and dark sessile glands are completely lacking.

Group 7 stands apart from the rest of sect. *Racemosae*. It comprises five species of annuals that approach the Cape sect. *Diascia*. The annuals are held together by habit and having two yellow patches either side by side within the central hollow or (in *D. alonsooides*) lying flat at the base of the two upper lobes. The species are *D. alonsooides*, *D. macrophylla*, *D. parviflora*, *D. veronicoides* and *D. dissimulans*. They are all found in the Cape and are more southerly and westerly than most other species of sect. *Racemosae*. Though it is convenient to treat them together, they are not all closely related; for instance *D. veronicoides* has a remarkable narrow fruit and elongate seeds. They may be relict species of a larger group that made the transition to the annual habit but has been largely superseded by species of sect. *Diascia*.

FLORAL BIOLOGY

Knowledge of the floral biology of *Diascia* is in its infancy. Vogel (1974) compared the structure and secretions of the black glands found on the corollas of *Diascia* with those of other Scrophulariaceae, notably *Angelonia* and *Calceolaria*, that he has studied in South America. The similarities are very great. The South American plants secrete oil, not nectar, and they are visited and pollinated by oil-collecting bees. Vogel recorded that, in South America, 275 species of bee in 8 genera were oil-collectors and that there were some 1 260 oil-flowers in 50 genera and 5 different families.

Having recognised that *Diascia* (and *Bowkeria verticillata*, another South African member of Scrophulariaceae) had oil-producing flowers, Vogel was able to predict that some species at least, of *Diascia* would prove to be pollinated by oil-collecting bees. However, he was unable to observe these in the field, and at that time none had been recorded from southern Africa. More recently Michener (1981) has suggested that bees of the genus *Rediviva* (Mellitidae) are oil-collectors and Professor Vogel has evidence on the basis of new material collected by U. Müller-Doblies, that a bee of this genus is associated with *Diascia longicornis* (Thunb.) Druce, a species of sect. *Diascia* (Vogel, 1984a, b). Within the geographical range of *Diascia* sect. *Racemosae*, species of bee assigned to *Rediviva* (Michener, 1981) are known from Lady Grey (north eastern Cape), from Royal Natal National Park (in the Drakensberg), and from Karkloof (in the Natal Midlands). If pollination of *Diascia* is restricted to this specialised endemic genus of oil-collecting bees, the fact that plants in cultivation in Britain have never set any seed is easily understandable.

The first observations on pollination in a species of sect. *Racemosae* have just recently been made by John Manning (University of Natal) on *D. anastrepta*, a species with two stamens held erect and producing a little yellow pollen, or none at all, the other two stamens projecting forwards along the palate and producing green pollen (Fig. 8). Mr. Manning observed visits of a bee [*Rediviva politissima* (Cockerell)] to the *Diascia* colony between 08h30 and 09h30 on 7 December, 1983, in a valley at 2 100 m below Ship's Prow Pass in the Natal Drakensberg. Three visits were observed. The bees fly directly into the corolla. The mandibles are thrust into the window of the posticous lip; the forelegs are spread into the spurs; the midlegs clasp the lower edge of the mouth of the spur; the tarsi of the hindlegs clasp the sinus between lateral and anticus petals; the abdomen is curved down and forwards so that it is the dorsum of the tip that rubs against the anthers. The forelegs seem to perform scraping movements. The reduced stamens, may, perhaps, support the bee below the thorax and abdomen.

From the observations made it would seem that the bee may visit only a single flower in the colony before leaving, or may visit a number. In any event it remains at a flower for only 2–3 seconds. Pollen is not collected from *D. anastrepta* and adheres to the tip of the abdomen fortuitously. The scopae may, however, contain copious pollen from other sources. Whether some secretion is obtained from the papillate cells of the window is as yet uncertain. Otherwise *D. anastrepta* is visited solely for the oil in the spurs.

Mr. Manning also observed that smaller bees (belonging to Halictidae) are more frequent visitors and enter the hollow in the anticus lip containing the stamens and style, and beneath the reduced stamens. They may also enter the flower from the sides or above. Pollen is collected assiduously, the midlegs being used to transfer the pollen to the scopae on the hindlegs.

These bees seem to be opportunists, both by their behaviour (the inconsistent manner in which they enter the flowers and the fact that they visit other species of *Diascia*, for example, *D. cordata*) and by their failure to make any use of the spurs or window.

While patches of black glands may be present on the surface of the corolla, variously disposed in different species, they are particularly well-developed within the spurs, often on one side only towards the tip. It will be apparent from the taxonomic section that these spurs vary from species to species in size and curvature. It is therefore very probable that different bees are concerned in the pollination of different species of *Diascia*.

Diversity in the precise pollination mechanism is also indicated by the differing positions in which the stamens are held. In the majority of species (15—see table) they project forward along the floor of the palate and must deposit pollen on the underside of the visitor (sternotribic pollination). In another group (probably 6 species—see table) the anthers are held erect and

pollen must be deposited on the head or back of the insect (nototribic pollination). In a third group (5 species, see table), we find the development of differences between the two pairs of stamens. The anthers of the posticous pair are held on the floor of the palate, those of the anticus pair are held erect. One of these species, *D. ramosa*, has the anthers of the erect stamens slightly larger than those of the lower pair; it has a spurless, campanulate, corolla, but is unfortunately known only from the type material and little can be said about it. In *D. anastrepta*, *D. megathura* and *D. purpurea* the anthers on the corolla floor produce grey-green pollen and the stigma is associated with these, while the upper anthers are much reduced and produce only small quantities of yellow pollen. Vogel (1974) has already pointed this out for *D. purpurea* and has since elaborated on this form of heteranthy where certain anthers are conspicuous and produce a little "food" pollen, whereas the effective pollen is produced by other less conspicuous anthers (Vogel, 1978). The small-flowered *D. lilacina* stands alone: both upper and lower anthers appear to be fully fertile and all produce grey-green pollen. The stigma, however, is positioned just above the lower anthers and *D. lilacina*, like the other species just mentioned, must have sternotribic pollination.

TABLE OF STAMINAL POSITIONS

<i>Stamens projecting forwards</i>	<i>Stamens erect</i>	<i>Two stamens erect, two projecting forwards</i>
1. cordata	2. racemulosa	3. ramosa
4. mollis	17. integerrima	13. lilacina
5. capsularis	18. dielsiana	14. anastrepta
6. barberae	19. patens (?)	15. megathura
7. tugelensis	20. rigescens	16. purpurea
8. vigilis	21. personata	
9. sp. (?)		
10. stricta		
11. fetcaniensis		
12. stachyoides		
22. macrophylla		
23. parviflora		
24. dissimulans		
25. veronicoides		
26. alonsooides		

It is to be noted, that, while *D. anastrepta*, *D. megathura* and *D. purpurea* are closely related, the other two species showing differentiation between the stamens belong to different taxonomic groups. It seems, therefore, that this development has arisen on three separate occasions within *Diascia* sect. *Racemosae*.

The window in the corolla has already been mentioned. It consists of a patch, or sometimes two patches, of yellow tissue usually flecked or netted with maroon. This patch is sometimes flat, more often shallowly concave (as seen from the face of the flower) and sometimes forming a distinct hollow cone which we have refrained from calling a spur only to avoid confusion with the true spurs. It seems likely that in all cases the window does act as a bright spot that may be visible to insect visitors, but what other function it may have is not yet known, though surely its diversity of form implies that such exists. Structurally the tissues of the window are well-marked, the inner epidermis consisting of cells with strongly developed papillae with dense contents (Fig. 1), quite unlike the smooth or slightly rounded cells of the rest of the corolla surface. In the young flower bud of *D. vigilis*, when it is still completely enclosed by the calyx, the corolla is pale green, the future window being marked by a maroon patch, coloured both inside and out. At a slightly later stage the outside is still maroon, but the inside has become yellow. There is clearly need for a detailed developmental study of these flowers, and a critical investigation to find out the function or functions that the various forms of the window perform. Until the behaviour of pollinators has been observed, it is fruitless to speculate how the differing details of spurs, gland patches, stamens and windows interact.

Several species of *Diascia* may grow in the same general area, sometimes in close proximity. For example, *D. vigilis* and *D. tugelensis* in Tugela Gorge; *D. purpurea*, *D. vigilis* and *D. tugelensis* along the path to The Sentinel; *D. anastrepta* and *D. purpurea* at the headwaters of the Loteni; *D. anastrepta*, *D. cordata* and *D. integerrima* in Sani Pass; *D. fetscaniensis*, *D. integerrima* and *D. stricta* on Ben Mcdhui. Yet we have seen no hybrids in these areas. The only evidence suggestive of hybridity is in the short and relatively broad-leaved forms of *D. integerrima*, for which hybridisation with *D. capsularis* is a possible explanation (see discussion under *D. integerrima*).

DIASCIA IN CULTIVATION

The first species of *Diascia* sect. *Racemosae* to be cultivated in Britain was *D. barberae*, of which seed collected in Lesotho by Col. J. H. Bowker was forwarded to Kew by his sister, Mrs. Barber, in 1870 (see under the species). It does not seem to have persisted for long.

Subsequently odd herbarium specimens, and the records of plants exhibited, in the *Journal of the Royal Horticultural Society*, show that plants under the name *D. barberae* were in cultivation at intervals over the next 100 years. The genus did not, however, become a horticultural favourite, as it must have done if it had become firmly established. Its failure was probably because plants are relatively short-lived and not fully hardy, do not set seed

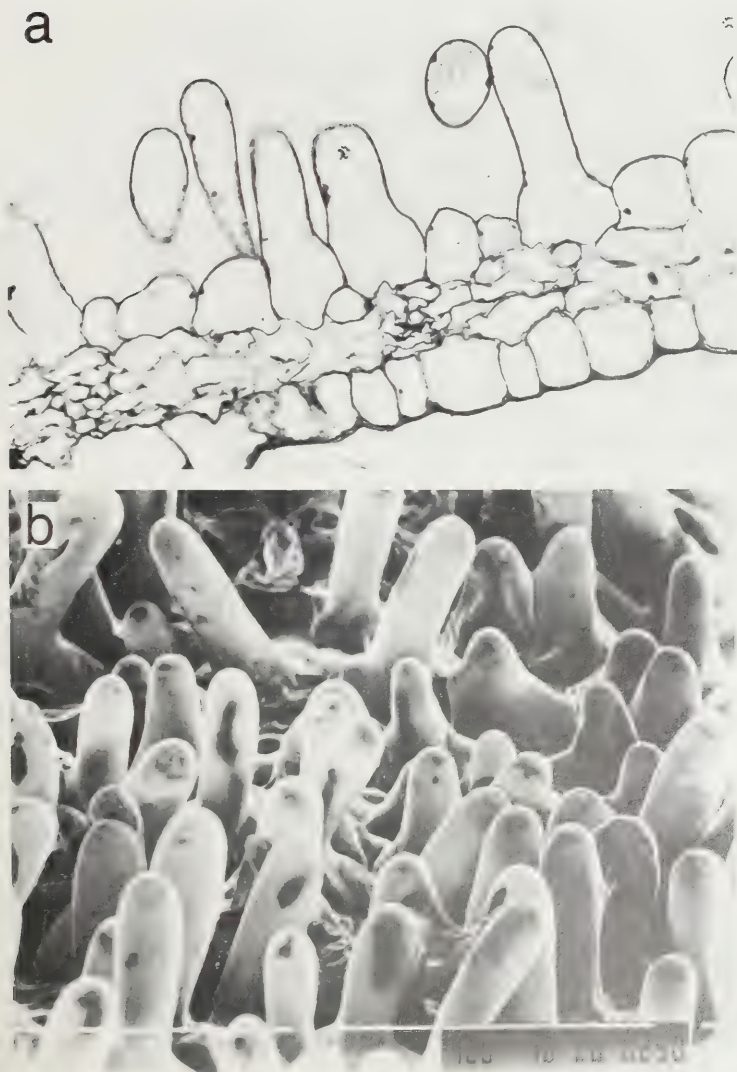


FIG. 1.

Papillose tissue of the window in *Diascia anastrepta*. a. T.S. ($\times 384$); b. surface view ($\times 275$). [Photos. A. Bennell]

in cultivation due to lack of their specialised pollinators (see under FLORAL BIOLOGY), and consequently need constant propagation from cuttings which need to be over-wintered under glass. Some of these temporary introductions seem to have been *D. capsularis* rather than *D. barberae*, but there are no details of origins.

More recently true *D. barberae* was grown at the Station Alpine de Lautaret from seed collected by L. Kofler in Lesotho, between Mokhotlong River and Orange River, 3 300–3 500 m, February 1962: there is a herbarium specimen dated 1969 at Kew, and it clearly shows the two small lateral patches of black glands characteristic of *D. barberae*.

In 1971 a cultivar, *Diascia* "Ruby Field", was exhibited at the Royal Horticultural Society in London (see J1 R. hort. Soc. 96: 67, 1971). It was said to be *D. barberae* \times *D. cordata*, but seems to be a selected strain of *D. barberae*. In any case, the plant cultivated in Britain in recent years as *D. cordata* (exhibited at R.H.S. in London in 1972) is again *D. barberae*. Both these last two plants, *D. barberae* and its selected strain, "Ruby Field", are now obtainable in the trade in Britain.

The National Botanic Gardens, Kirstenbosch, has been successfully growing *D. integerrima* (as *D. moltenensis*) for some years and is now experimenting with other species.

D. rigescens, introduced from Mt. Kemp in the eastern Cape in 1977 (Hilliard & Burt 11032), has caught on in British horticulture and is becoming widely grown. Being a more robust species, it has better garden potential than the others, which tend to be of sprawling habit. However, some forms of *D. rigescens*, for example from the Zuurberg at Weza in southern Natal, would be less attractive as they have smaller, paler flowers and more lax habit. Several other species, including *D. anastrepta* (Hilliard & Burt 13703), *D. barberae* (new introduction, Hilliard & Burt 13736), *D. fetcaniensis* (Hilliard & Burt 12318), *D. megathura* (Hilliard & Burt 12465), *D. stachyoides* (Hilliard & Burt 14554), have been successfully introduced to the Royal Botanic Garden, Edinburgh, and are particularly successful at the Garden's outstation, the Logan Botanic Garden on the Mull of Gallows.

Diascia sect. **Racemosae** (Benth.) Wettst. in Engl. & Prantl, Nat. Pflanzenfam. 4(3B): 54 (1894).

Diascia ****Racemosae* Benth. in Hook., Comp. Bot. Mag. 2:17 (1836).

Lectotype: *D. capsularis* Benth.

Annual or perennial herbs, *leaves* opposite and decussate, base broad, usually petiolate. *Calyx* 5-partite. *Corolla* with a short tube, often invagi-

nated, usually with two lateral spurs with dark sessile glands within, limb bilabiate, lower lip three-lobed, upper lip two-lobed with a yellow translucent "window" below the sinus, more rarely the window split into two discrete patches. *Stamens* four, filaments of the anticus pair twisted at the base to bring them into the posticus position, anthers usually fertile, occasionally those of the anticus pair reduced or sterile. *Ovary* bilocular, ovules two to many in each loculus. *Capsule* septicidal, the valves shortly bifid; seeds usually strongly curved, straight in one species, heavily ornamented.

KEY TO THE SPECIES

- 1a Anthers of the anticus pair of stamens (which are twisted erect into the posticus position) noticeably smaller than those of the posticus pair, fertile or sterile; posticus stamens projecting straight forward 2
- 1b Anthers all alike, all four stamens either erect or projecting straight forward 7
- 2a Corollas with 2 lateral spurs 3
- 2b Corollas without lateral spurs 6
- 3a Corolla limb at least 18 mm long; leaves with distinct petioles 4
- 3b Corolla limb c. 12 mm long; leaves sessile 21. ***D. personata***
- 4a Spurs 3–4 mm long, curved down and forward under the bowl-shaped corolla tube 16. ***D. purpurea***
- 4b Spurs 6–8 mm long, spreading at right angles to the corolla tube 5
- 5a Hairs on the pedicels at least 0.5 mm long, those on the filaments of the reduced stamens mostly at least 1 mm long 15. ***D. megathura***
- 5b Hairs on the pedicels scarcely 0.25 mm long, those on the filaments of the reduced stamens up to 0.5 mm long 14. ***D. anastrepta***
- 6a Window drawn out into a hollow cone 13. ***D. lilacina***
- 6b Window with 2 very shallow concavities 3. ***D. ramosa***
- 7a Leaves in many pairs (rarely few and then flowering in seedling stage), either sessile or with petioles diminishing only gradually in length upwards. Mostly perennial, a few annual 8
- 7b Leaves in up to 7 pairs on each stem or branch, petiole-length diminishing rapidly upwards (lowermost pair of leaves on long petioles, uppermost almost sessile). Annual herbs 26
- 8a Leaves with petioles at least 1 mm long (ignore uppermost, reduced, leaves, which may be sessile) 9
- 8b Leaves sessile 25
- 9a Style c. 1.5 mm long; perennial herbs 10
- 9b Styles mostly 2–3 mm long; if only 1.75 mm, then an annual herb 16
- 10a Leaves narrowly to broadly ovate, ratio of length to breadth 1–1.5:1 11
- 10b Leaves linear, linear-lanceolate or oblong-lanceolate, ratio of length to breadth (2–)5–20:1 14
- 11a Spurs 4–7 mm long (measured on the inside, adjacent to the opening to the corolla tube) 12
- 11b Spurs 8–9 mm long 1. ***D. cordata***
- 12a Hairs on the pedicels mostly at least 0.5 mm long 12. ***D. stachyoides***
- 12b Hairs on the pedicels up to c. 0.25 mm long 13
- 13a Filaments 2 mm long; palate not keeled 9. ***Diascia* sp.**
- 13b Filaments 2.75–3 mm long; palate strongly raised into a median keel separating the entrances to the two spurs 17. ***D. integerrima***

- 14a Palate not raised, spurs either patent or diverging at an angle of c. 45° , \pm straight; filaments 2–2,5 mm long 15
- 14b Palate strongly raised into a median keel separating the entrances to the two spurs, spurs directed straight down almost parallel to each other, tips strongly incurved; filaments 2,75–3 mm long 17. **D. integerrima**
- 15a Spurs 4–5 mm long, diverging at an angle of c. 45° ; central patch of dark sessile glands present at base of anticus corolla lobe 19. **D. patens**
- 15b Spurs 3–4 mm long, spreading at right angles to the tube; no dark sessile glands on face of corolla 18. **D. dielsiana**
- 16a Palate either with a centrally placed patch of dark sessile glands or glands wanting 17
- 16b Palate with 2 laterally placed patches of dark sessile glands 6. **D. barberae**
- 17a Perennial herbs, stems up to 2 mm diam. 18
- 17b Annual herbs, lower part of main stem 3–4 mm diam. 23
- 18a Corolla limb 15–20 \times 12–15 mm, spurs (measured on inside, adjacent to opening to corolla tube) 4 mm long, leaves mostly 4–8 mm broad 10. **D. stricta**
- 18b Corolla limb 18–28 \times 15–25 mm, spurs 5–11 mm long, leaves mostly 5–20 mm broad 19
- 19a Many of the hairs on the pedicels at least 0,5 mm long 20
- 19b Hairs on the pedicels scarcely 0,25 mm long or sometimes wanting 21
- 20a Base of corolla tube invaginated, the opening lying at the bottom of a hollow and the calyx segments thereby reflexed; window drawn out into a cone 1,5–2,5 mm deep; filaments glandular-pilose 11. **D. fetcaniensis**
- 20b Base of corolla tube scarcely invaginated, the calyx segments therefore lying flat against the tube; window shallowly concave, c. 1–1,5 mm deep; filaments glandular-pubescent 8. **D. vigilis**
- 21a Spurs (measured on inside adjacent to opening in corolla tube) 5–7 mm long, tips markedly swollen; style 2,75–3 mm long 7. **D. tugelensis**
- 21b Spurs 7–11 mm long, narrowed towards the tips; styles c. 2–2,5 mm long 22
- 22a Leaves ovate or ovate-lanceolate, mostly 10–25 \times 5–20 mm (ratio 1–2:1); style c. 2,5 mm; usually 2 lateral patches of glands on palate ... 6. **D. barberae**
- 22b Leaves deltoid or deltoid-ovate, mostly 11–32 \times 5–17 mm (ratio 2–3(–5):1); style c. 2 mm; glands, if present, on centre of palate 15. **D. capsularis**
- 23a Palate raised into a median keel separating the entrances to the two spurs; keel clad in dark glands 2. **D. racemulosa**
- 23b Palate not raised, dark glands wanting 24
- 24a Corolla without lateral spurs; ovules 2 in each locus 3. **D. ramosa**
- 24b Corolla with lateral spurs c. 3 mm long; ovules many in each locus 4. **D. mollis**
- 25a Spurs c. 3 mm long (measured on inside adjacent to opening in corolla tube) directed straight down and with dark sessile glands within; palate strongly raised into a short median keel separating the openings to the two spurs; keel densely clad in stalked glands yellow when fresh 20. **D. rigescens**
- 25b Spurs c. 1,5 mm long, directed inwards, dark sessile glands wanting; palate strongly raised into a pouched transverse keel closing the mouth and hiding the openings to the spurs; keel eglandular 21. **D. personata**
- 26a Corolla subrotate, without pouches or spurs 26. **D. alonsooides**
- 26b Corolla distinctly bilabiate, spurred 27
- 27a Spurs up to 4 mm long 28
- 27b Spurs 10–13 mm long 22. **D. macrophylla**
- 28a Filaments of posticous pair of stamens distinctly branched 24. **D. dissimulans**

- 28b Filaments of posticous stamens not branched, at most abruptly curved and thickened at the tip with, rarely, a minute projection as well 29
- 29a Spurs up to 1 mm long, curved inwards; capsules oblanceolate in outline, seeds curved and ridged 23. **D. parviflora**
- 29b Spurs c. 4 mm long, curved out and down, capsules linear, seeds straight, muricate 25. **D. veronicoides**

GROUP 1

1. ***Diascia cordata*** N.E. Br. in Kew Bull. **1895**: 151 (1895); Hiern in Thiselton-Dyer, Fl. Cap. **4** (2): 158 (1904). Lectotype: Drakensberg Range, [Estcourt distr.] Tiger Cave Valley, 6000–7000 ft., Jan. 1895, *Evans* 382 (K).

Perennial herb, stock eventually woody, up to c. 10 mm diam., stems many from the crown, straggling, of indeterminate length, up to 2.5 mm diam., simple below, branching above, branches often flagelliform, glabrous. *Leaves* mostly 13–30(–50) × 13–25(–38) mm, diminishing in size upwards, ovate, apex obtuse, base subcordate, margins sharply serrate, glabrous; petiole 2.5–7 mm long. *Flowers* many in very lax leafy racemes, sometimes compounded into panicles; lower bracts leaf-like, becoming much smaller upwards; pedicels mostly 18–37 mm long, often wide-spreading, often recurved in fruit, glabrous to sparsely glandular-pubescent. *Calyx* segments lanceolate, two anticus ones c. 4–4.5 × 1–1.5 mm, three posticus ones slightly smaller, glabrous. *Corolla* tube c. 4 mm long, deeply invaginated, two lateral spurs c. 8–9 mm long, slightly curved, strongly divergent in a downward direction, with a patch of dark sessile glands within near the tips; limb c. 18–20 × 11–17 mm, anticus lobe c. 8–10 × 10–13 mm, lateral lobes 5 × 5.5–7 mm, posticus lobes 4–4.5 × 4–5 mm, all subrotund, pale or rose-pink, sparsely glandular-pubescent outside, glabrous inside except for a centrally placed patch of dark sessile glands on the palate (or glands sometimes wanting), palate slightly raised with two parallel median channels to accommodate the filaments, the “window” concave with two further yellow elliptic concavities flanked by reddish blotches and streaks. *Stamens* projecting forward, filaments c. 2.25 mm long, glandular-puberulous, anthers 1 mm long, cohering strongly, pollen yellow. *Ovary* 1–1.5 × 1 mm, deltoid in outline, ovules 2–4 in each loculus; style 1.5 mm long, stigma capitate, lying between the anthers. *Capsules* 3–5 × 3–4 mm, ovoid; seeds c. 1.75 mm long, ridged but not winged. Figs 2 d–f, 3 a–d.

SELECTED CITATIONS

NATAL—2929 (Underberg): Estcourt district, near Champagne Castle Hotel (-AB), c. 5000 ft., 30/1/1944, *Acocks* 10104 (PRE); Giants Castle Game Reserve, Bannerman area, 7500 ft., 10/2/1965, *Trauseld* 324 (PRE); *ibidem*, c. 6000 ft.,

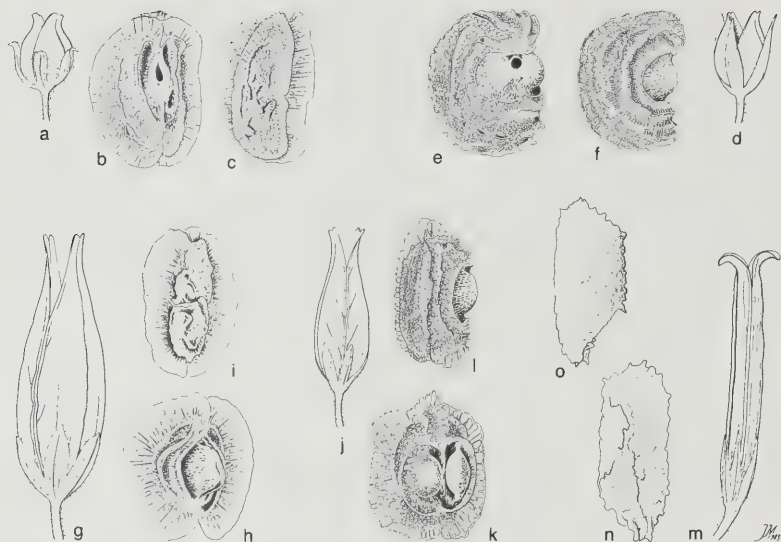


FIG. 2.

Fruits and seeds of *Diascia*. a–c, *D. rigescens* (Hilliard & Burt 12353); d–f, *D. cordata* (d, Hilliard & Burt 11821; e, f, Hilliard & Burt 15522); g–i, *D. megathura* (Hilliard & Burt 12465); j–l, *D. integerrima* (Hilliard 3962); m–o *D. veronicoides* (m, Compton 11552; n, o, Grant & Theiler 4890). a, d, g, j, m $\times 2$; b, c, e, f $\times 12$; h, i, k, l $\times 17.5$; n, o $\times 25$.

14/12/1978, Stewart 2075 (E, K, NU); Hlatikulu, Mooi River watershed (-BA), 23/12/1901, Johnston 756 (E); Near Tabamhlope Police Post, c. 5500 ft., 19/11/1944, Acocks 10783 (BOL); Between Howick and Estcourt, 4000 ft., 18/12/1885, Wood 3564 (BOL, K, SAM); Lion's River distr., Karkloof (-AC), 5400 ft., 20/2/1895, Schlechter 6831 (BOL, GRA, PRE); Mpendhle distr., Loteni Nature Reserve, Ngondwini Valley (-AD), c. 1 800 m, 24/12/1978, Hilliard & Burt 11821 (E, NU); Vergelegen Nature Reserve, Mahlangubo River valley (-CB), 1/1/1978, Hilliard & Burt 11150 (E, NU); Above Vergelegen, tributary stream of Ntshishini River, 2 225 m, 4/12/1982, Hilliard & Burt 15878 (E, K, NU, PRE); Underberg distr., Sani Pass, c. 2 440 m, 17/2/1982, Hilliard & Burt 15522 (E, NU); Polela, 4–5000 ft., 8/1/1892, Wood 4582 (BOL, NH, SAM).

Diascia cordata appears to be confined to the Natal Drakensberg and its foothills, between c. 1 500 and 2 440 m. It grows in rank vegetation along streams, sprawling and clambering, and in Sani Pass it forms conspicuous

tangles along the roadside. It is easily recognised by its very lax leafy inflorescences, corollas with long spreading spurs and twin yellow spots in the "window", and short broad capsules, often containing only one seed in each locus. The species with which it is occasionally confused are *D. racemulosa*, *D. ramosa* and *D. mollis*; the distinctions are given there.

2. *Diascia racemulosa* Benth. in Hook., Comp. Bot. Mag. 2: 17 (1836) et in DC., Prodr. 10: 259 (1846); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 156 (1904). Type: [Transkei] Pondoland, bushy places in valleys, between Umtata River and Umzimkulu River, 1000–2000 ft., May, *Drège* 4849 (K, holo.; E, iso.).

D. aliciae Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 155 (1904). Type: Transkei, Kentani distr., in valleys and along streams, 1500 ft., Feb. to May, *Pegler* 401 (K, holo.; BM, BOL, SAM, iso.).

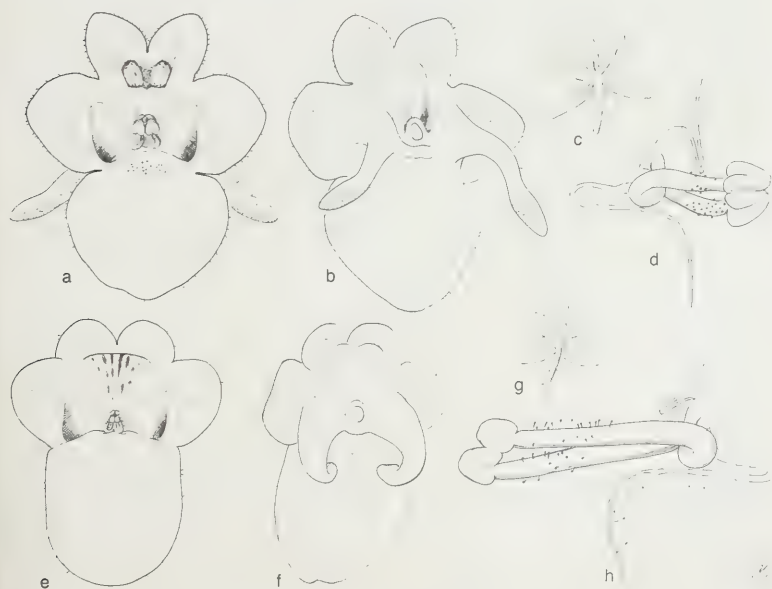


FIG. 3.

Diascia cordata (Hilliard & Burt 15522): a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, stamens ($\times 12.5$). *D. mollis* (Hutchings 428): e, corolla, front view ($\times 2.5$); f, corolla, back view ($\times 2.5$); g, calyx ($\times 2.5$); h, stamens ($\times 10$).

D. expolita Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 156 (1904). Type: Natal, Ismont [near Mid Illovo], 2000 ft., April, Wood 1841 (K, holo.; NH, SAM, iso.).

Diffuse annual herb, main stem up to 750 mm long, 3–4 mm diam., branching low down into lax spreading panicles, glabrous. *Leaves* on the main branches mostly $35\text{--}55 \times 28\text{--}40$ mm, smaller upwards, ovate, apex acute, base subcordate, margins sharply serrate, glabrous; petiole 4–11 mm long. *Flowers* many in somewhat crowded or more lax and then flagelliform racemes compounded into panicles; lowermost bracts leaf-like, rapidly smaller upwards and then mostly $4\text{--}8 \times 1\text{--}2$ mm, lanceolate, shortly acuminate, glabrous; pedicels mostly 15–35 mm long, filiform, wide-spreading, sometimes recurved in fruit, glabrous to sparsely glandular-pubescent. *Calyx* segments lanceolate, acute to shortly acuminate, two anticus ones $2,5\text{--}3,5 \times 0,75\text{--}1$ mm, three posticus ones slightly smaller, glabrous. *Corolla* tube c. 4 mm long, not invaginated, two lateral spurs c. 5 mm long, slightly curved, directed downwards, with a patch of dark sessile glands within near the tips; limb c. $14\text{--}15 \times 12\text{--}13$ mm, anticus lobe c. 7×7 mm, subrotund, two lateral lobes, $3,5\text{--}4 \times 3\text{--}4$ mm, oblong-elliptic, two posticus lobes $3\text{--}3,5 \times 2,5\text{--}3$ mm, oblong-elliptic, pale rose-pink, purplish in the throat, sparsely glandular-pubescent outside, glabrous inside except for a patch of dark sessile glands on the palate, which is elevated into a median keel separating the openings to the two spurs, “window” deeply concave, hemispherical. *Stamens* erect, filaments of the anticus pair c. 2,5 mm long, straight except for the usual twist at the base, posticus pair sharply bent above the middle and thickened there, all glandular-pubescent; anthers 0,75 mm long, cohering strongly, partly hidden in the window. *Ovary* c. $1,25\text{--}1,5 \times 1$ mm, ovules 3–6 in each loculus; style 1,75–2 mm long, stigma capitate, lying between the anthers. *Capsules* c. 5×3 mm, ovoid; seeds 1,5 mm long, curved, ridged.

CITATIONS

TRANSKEI—3129: Pondoland, e hort. Kirstenbosch 3/1933, Robinson 376/33 (BOL); 7 miles from Spes Bona on road to Mtontsasa (-BD), 8/7/1976, van Wyk 1537 (PRE).
—3228 (Butterworth): Kentani distr., 3,8 miles N W of Kentani (-AD), 10/3/1955, Marais 736 (K, PRE).

Diascis racemulosa grows in damp sheltered places along streams or on the margins of forest patches. In recent years, it has been found only in Transkei, between c. 300 and 600 m above sea level. The original collection of *D. expolita* came from the farm Ismont near Mid Illovo in southern Natal, at much the same altitude. No specimens of *Diascia* have ever been

re-collected in coastal Natal; the natural vegetation on Ismont has been devastated by plantations of sugar and trees, and the streamsides and forest patches laid waste; we have searched there in vain. But despite the drawback of working entirely from dried material, some of it in poor condition, there is little doubt that both *D. expolita* and *D. aliciae* are conspecific with *D. racemulosa*, which Drège collected between the Umtata and Umzimkulu rivers in 1836.

Diascia racemulosa is occasionally confused with *D. cordata*, which has similar lax inflorescences, but *D. cordata*, a perennial herb, has the corolla tube deeply invaginated, lateral spurs 8–9 mm long (not c. 5 mm), corolla limb c. 18–20 mm long (not 14–15 mm) and the palate only slightly raised (not forming a median keel), and reclining (not erect) stamens.

3. ***Diascia ramosa*** Scott Elliot in Journ. Bot. **29**: 69 (1891); Hiern in Thiselton-Dyer, Fl. Cap **4** (2): 157 (1904). Lectotype: Cape, Somerset East, Boschberg, 4500 ft., April, MacOwan 1968 (K; BM, PRE, isolecto.).

A diffuse herb, possibly perennial, stems loosely branched above, flexuous, glabrous. *Leaves* on the main branches c. 13–35 × 10–15 mm, smaller on the inflorescence branches, ovate, apex acute, base subcordate, margins with a few sharp or obscure teeth, glabrous; petiole 1–2 mm long. *Flowers* many in somewhat crowded to lax racemes, sometimes compounded into very lax panicles; lowermost bracts c. 3 × 2 mm, otherwise resembling the leaves; pedicels c. 7–14 mm long, filiform, they and the rhachis glandular-puberulous. *Calyx* lobes lanceolate, acute, two anticus ones c. 2 × 1 mm, three posticus ones slightly smaller, glandular-puberulous. *Corolla* tube c. 2 × 3 mm, not invaginated, broadly campanulate without lateral spurs or pouches; limb c. 8–9 × 7–9 mm, anticus lobe 3–4 × 3–4 mm, two lateral lobes 2–3 × 2.5–3.5 mm, two posticus lobes c. 2–3 × 2.75–3 mm, all subrotund, probably all rose-pink, glandular-pubescent outside, glabrous inside, "window" very shallowly concave with two further yellow lateral concavities. *Stamens* unalike, filaments of the posticus pair 2 mm long, directed straight forward, anthers 0.5 mm long; filaments of the anticus pair 1.5 mm long, twisted erect into the posticus position, anthers 0.75 mm long, cohering strongly. *Ovary* 0.75 × 0.75 mm, ovules 2 in each loculus; style 2 mm long, stigma capitate. *Capsule* c. 1.75 × 1.75 mm; seeds c. 2 mm long, curved, ridged.

CITATION

CAPE—3225 (Somerset East): Boschberg (-DA), 4000 ft., beside path in bush, May, Scott Elliot 488 (E, K).

Diascia ramosa is known only from the two syntypes collected on Bosch-

berg, Somerset East, at the end of the last century. We have sought the plant there without success, but the forest on the mountain has been badly disturbed. Hiern followed Scott Elliot in describing the corolla as having two short rounded spurs or pouches; but the apparent rounded pouch visible on a corolla of the lectotype proved to be an artefact of pressing and drying.

The corolla is remarkable in that it is campanulate, with the limb only slightly bilabiate, very different from the twin-spurred corolla of *D. cordata*, with which the relationship of *D. ramosa* surely lies: they are similar in habit, foliage, and their short broad capsules with few seeds.

4. *Diascia mollis* Hilliard & Burtt, species nova; *D. racemulosae* Benth. affinis sed calyce glanduloso-pubescente (nec glabro), corollae tubo invaginato, palato vix elevato et glandulis sessilibus destituto (nec valde elevato-carinato glandulis sessilibus fuscis praedito), filamentis 3 mm longis (nec c. 2,5 mm) porrectis (nec erectis), stylo 2,25–2,5 mm longo (nec 1,75–2 mm) distinguenda.

Herba annua, diffusa; caulis ad 750 mm longus, simplex vel inferne ramosus, glaber, in inflorescentia glanduloso-pubescent. Folia plerumque 16–50 × 18–40 mm, sursum decrescentia, ovata, glabra, apice acuto vel obtuso, basi subcordata, marginibus saepe acute interdum obscure serrata; petiulus 5–16 mm longus. Flores numerosi, in racemos densos vel laxiores et flagelli-formes saepe in paniculam ramosos dispositi; bractae infimae foliaceae, sursum celeriter minores et plerumque 3–4 × 1–2 mm, lanceolatae, acutae vel acuminatae, plerumque glanduloso-pubescentes interdum pilis paucis vel nullis pedicelli plerumque 11–20 mm longi, filiformes, plerumque late patentes, glanduloso-pubescentes. Calyx 5-partitus; segmenta lanceolata acutissima, glanduloso-pubescentia, 2 antica c. 3 × 0,75–1,25 mm, 3 postica paulo minora. Corolla tubo c. 3 mm longo invaginato; calcar duo lateralia c. 3–5 mm longa, deorsum curvata, intus ad apices glandulis sessilibus fuscis praedita; limbus c. 17 × 15 mm, lobo antico c. 8–9 × 8–9 mm, duobus lateralibus 3,5–5 × 4–6 mm, duobus posticis c. 3 × 3–4 mm, omnibus subrotundatis roseis extra parce glanduloso-pubescentibus intus glabris, palato vix elevato; fenestra concava, c. 1,5 mm alta. Stamina 4, aequalia, porrecta, filamentis 3 mm longis glanduloso-puberulis; antherae 0,75–1 mm longe, valde inter se cohaerentes. Ovarium 0,25–1,5 × 0,75–1 mm; ovula in utroque loculo saltem 6; stylus 2,25–2,5 mm longus; stigma capitatum inter antheras dispositum. Capsula c. 4,5–6 × 2–3 mm; semina 1,25 mm longa, leviter costata.

Type: Transkei—3128 (Umtata): Libode distr., near Misty Mount, Corana Location (-DB), 12/4/1954, Barker 8242 (NBG, holo.).

Diffuse annual herb, main stem up to 750 mm long, 3–4 mm diam. (but plant will flower in seedling stage), simple or branching low down into spreading panicles, glabrous becoming glandular-pubescent on the inflorescence axes. *Leaves* glabrous, mostly $16\text{--}50 \times 18\text{--}40$ mm, smaller upwards, ovate, apex acute to obtuse, base subcordate, margins often sharply serrate, occasionally only obscurely so; petiole 5–16 mm long. *Flowers* many in somewhat crowded or more lax and flagelliform racemes often compounded into panicles; lowermost bracts leaf-like, rapidly smaller upwards and then mostly $3\text{--}4 \times 1\text{--}2$ mm, lanceolate, acute to acuminate, mostly glandular-pubescent, hairs occasionally few or wanting; pedicels mostly 11–20 mm long, filiform, mostly wide-spreading, glandular-pubescent. *Calyx* segments lanceolate, very acute, glandular-pubescent, two anticonous ones c. $3 \times 0,75\text{--}1,25$ mm, three posticous ones slightly smaller. *Corolla* tube c. 3 mm long, invaginated, two lateral spurs c. 3–5 mm long, curved downwards, with a patch of dark sessile glands within near the tips; limb c. 17×15 mm, anticonous lobe c. $8\text{--}9 \times 8\text{--}9$ mm, two lateral lobes $3,5\text{--}5 \times 4\text{--}6$ mm, two posticous lobes c. $3 \times 3\text{--}4$ mm, all subrotund, rose-pink, sparsely glandular-pubescent outside, glabrous inside, without sessile glands on the palate, which is scarcely raised; “window” concave, c. 1,5 mm deep. *Stamens* projecting forward, filaments 3 mm long, glandular-puberulous; anthers 0,75–1 mm long, cohering strongly. *Ovary* $1,25\text{--}1,5 \times 0,75\text{--}1$ mm, ovules at least 6 in each loculus; style 2,25–2,5 mm long; stigma capitate, lying between the anthers. *Capsules* c. $4,5\text{--}6 \times 2\text{--}3$ mm; seeds 1,25 mm long, weakly ridged. Fig. 3 e–h.

CITATIONS

TRANSKEI—3129 (Port St. John's): Marubeni (-AC), 20/4/1983, *Hutchings* 428 (E, NU); Near Port St. John's. Tumboa (-DA), 30/12/1927, *Grant & Blenkiron* 3550 (BOL, PRE); c. 3 miles N E of Ludalasi Store, 800 ft., 11/9/1956, *Codd* 9751 (NBG); Ngqeleni distr., Ngqeleni commonage (-CA), 13/5/1954, *Barker* 8246 (NBG); Mqanduli distr., Coffee Bay (-CC), 6/3/1953, *Theron* 1490 (PRE); ibidem, 3/1947, *Lewis* 3030 (SAM).

—3228 (Butterworth): Willowvale distr., between Mpozolo School and Mendu, Msendu Halt (-BB), 1700 ft., 27/1/1966, *Wood* 63 (E, NU).

—3229 (Talemofu): Elliotdale distr., 5 miles inland of Hole-in-the-Wall (-AA), 1000 ft., 20/2/1966, *Wells* 3526 (PRE).

CAPE—3227 (Stutterheim): Victoria East, Hogsback, Bongo Mountains (-CA; 5000 ft., 20/4/1947, *Sidey* 706 (PRE).

Diascia mollis has a relatively wide geographical range, from Libode and Port St. John's in Transkei to Hogsback in the mountains almost due north of King William's Town, and an equally wide altitudinal range, from sea level to 1 500 m. It has been variously recorded as growing on and at the foot of cliffs close to the sea, in grassland, and in forest. It is clearly a rather

delicate herb, so, in common with many of its congeners, it probably favours damp and somewhat sheltered places among the coarse grasses and bushes that are found marginal to forest patches, which, in Transkei, descend to the sea.

Diascia mollis is commonly misidentified as *D. aliciae*, that is *D. racemulosa*, and occasionally as *D. cordata*. It is easily distinguished from *D. racemulosa* by its glandular-hairy calyx, invaginated corolla tube, palate without dark sessile glands and longer filaments (3, not 2.5 mm) which project straight forward (not erect, the anthers partially hidden in the window). *Diascia cordata* also has the corolla tube invaginated and the filaments directed forwards, but its perennial habit, glabrous calyx, longer spurs (8–9 mm, not 3–5 mm) and shorter filaments (c. 2.25 mm, not 3 mm) easily distinguish it.

GROUP 2

5. *Diascia capsularis* Benth. in Hook., Comp. Bot. Mag. 2: 18 (1836) et in DC., Prodr. 10: 259 (1846); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 160 (1904); Batten & Bokelmann, Wild Flow. E Cape Prov. 133, pl. 105, 4 (1966). Type: Cape, Uitenhage and Albany, 1836, *Ecklon* (K, holo.; E, GRA, SAM prob. iso.).

Hemimeris elegans Hiern in Journ. Bot. 39: 102 (1901). Type: Orange River Colony, without precise locality, 1900, *Pateshall Thomas s.n.* (BM).

Diascia elegans (Hiern) Hiern in Fl. Cap. 4 (2): 159 (1904).

D. capsularis var. *flagellaris* Hiern in Fl. Cap. 4 (2): 160 (1904). Lectotype: Cape, Somerset div., Bruintjes Hoogte, 19/5/1813, *Burchell 3004* (K).

Perennial herb, taproot eventually thick and woody (c. 10 mm at crown), stems many from the crown, tufted, up to c. 600 mm long, 2 mm diam., simple or branching from the base, decumbent and rooting near the base, glabrous. *Leaves* glabrous, mostly 11–32 × 5–17 mm (ratio 2–3(–5):1), deltoid or deltoid-ovate, apex acute, base almost truncate to subcordate in larger leaves, margins sharply serrate, teeth few, mainly in the lower half; petiole 1–6 mm long. *Flowers* few to several in a lax terminal raceme, usually simple, sometimes branched at the base; bracts up to c. 4 × 3 mm, ovate, very acute, glandular-puberulous; pedicels mostly 12–35 mm long, ascending at an angle of c. 45°, they and the inflorescence rhachis glandular-puberulous, the single stalk cell very small. *Calyx* segments reflexed, lanceolate, the two anticus ones c. 3–4 × 1.5–2, three posticus ones slightly smaller, all green, glandular-puberulous. *Corolla* tube c. 6–7 mm long, invaginated, two lateral spurs c. 9–11 mm long, directed straight down or down and slightly out and then describing a broad V, with a patch of dark

sessile glands within near the tips; limb c. 25×22 –25 mm, anticous lobe c. 11 – 12×15 –16, lateral lobes c. 7 – 9×9 –11 mm, posticous lobes c. 5 – 7×6 –7, all subrotund, all “salmon-pink” to “scarlet”, “brick-red” or “crimson-lake”, sparsely glandular-puberulous outside, usually glabrous inside, occasionally with a patch of dark short-stalked glands centrally placed on face of the slightly raised palate, the “window” concave, yellow and maroon. *Stamens* projecting forward; anthers c. 1 mm long, cohering strongly. *Ovary* c. 2×1.75 mm, deltoid in outline, ovules many in each loculus; style c. 2 mm long, stigma capitate. *Capsules* 9 – 17×5 –6 mm, oblanceolate in outline; seeds c. 1.75 mm long, broadly winged, ribbed. Fig. 4 a–d.



FIG. 4.

Diascia capsularis (NBG 833/77); a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, stamens ($\times 7.5$). *D. barberae* (Hilliard & Burt 8832); e, corolla, front view ($\times 2.5$); f, corolla, back view ($\times 2.5$); g, calyx ($\times 2.5$); h, stamens ($\times 7$).

SELECTED CITATIONS

LESOTHO—2927 (Maseru): Morija, slopes of Makhoarane Mountain (-DA), 4/4/1913, *Dieterlen* 983 (BM, K, PRE, SAM); Maseru, 25/1/1951, *Compton* 22563 (NBG); Mafeteng distr., Mafeteng (-CC), 6000 ft., 23/12/1933, *Gerstner* 230 (PRE).

ORANGE FREE STATE—2926 (Bloemfontein): Thaba Nchu Mountain (-BB), 22/1/1982, *Matthews* 841 (NBG, NU); Dewetsdorp (-DA), 13/4/1950, *Steyn* 943 (NBG).

—2927 (Maseru): Near Ladybrand, Vinies (-AB), 3/1917, *Page* s.n. (BOL); Wepener (-CA), c. 5000 ft., 29/1/1945, *Acocks* 11173 (PRE).

—3025 (Colesberg): Phillippolis distr., near Spioenkop (-BC), c. 5050 ft., 8/9/1927, *Smith* 4474 (PRE).

CAPE—3026 (Aliwal North): Rouxville distr., 14 km from Aliwal North on road to Bethulie (-DA), 3/3/1981, *Herman* 438 (PRE); Near Aliwal North, Elandshoek, 4700 ft., 5/1903, *F. Bolus* 10497 (BOL, GRA, K); Ruigtefontein, 4/1929, *Thode* A1832 (K, NH, PRE); Albert div., Burghersdorp (-CD), 2/1898, *Guthrie* 4910 (BOL); Sterkstroom distr., Stormberg, Penhoek Pass (-BC), 12/12/1942, *Barker* 2199 (BOL, NBG); 16 miles W of Dordrecht (-BA), 13/4/1957, *Theron* 2184 (K, PRE).

—3124 (Hanover): Near Naauw Poort (-BB), 2/1896, *Denoon* 60 (BOL); North of Compassberg (-DA), 4/2/1976, *Wisura* 3589 (NBG); Wapadsberg, Mountain Horse Station (-DD), 3/1813, *Burchell* 2820 (K); Lootsberg Pass (-DC), c. 5500 ft., 28/3/1947, *Acocks* 13544 (K, PRE).

—3126 (Queenstown): Bamboesberg (-AC), 1/6/1981, *Van Schoor* s.n. (NBG).

—3224 (Graaff Reinet): S face of Cave Mountain (-BC), 3500 ft., 24/5/1865, *Bolus* 58 (BOL, K); Farm Rheboksberg, 4/3/1930, *Galpin* 10004 (K, PRE); Koudeveldt Berg (-AA), 4000 ft., 3/1878, *Tyson* s.n. (BOL, BM); Zuurpoort, farm Doornbosch, 3/6/1976, *Wisura* 3585 (NBG).

—3225 (Somerset East): Cradock distr., Mountain Zebra Park (-BA), c. 4800 ft., 21/1/1969, *Muller* 630 (PRE); Tarkastad distr., Martha, 6330 ft., 20/4/1950, *Killick* 858 (PRE); Queenstown distr., Upper Zwart Kei, Mount Hope Farm, 5000 ft., 10/3/1900, *Galpin* 2676 (K, PRE); Somerset East distr., Boschberg (-DC), 3000 ft., *MacOwan* 2005 (GRA, PRE); Bruintjieshoogte (-CB), 19/5/1813, *Burchell* 3015 (K).

—3325 (Port Elizabeth): 1–12 miles N of Zuurberg Hotel (-BC), 2000–2500 ft., 25/4/1947, *Story* 2388.

—3326 (Grahamstown): 13 miles SW of Grahamstown (-BC), c. 1200 ft., 24/4/1947, *Acocks* 13622 (K, PRE); Alexandria distr., farm Spadona (-DA), 24/6/1931, *Galpin* 10753 (BOL, K, PRE); Bathurst distr., farm Hopewell, 7/7/1947, *Compton* 19822 (NBG); Stockenström div., Seymour (-DB), *Scott Elliot* 253 (E).

Diascia capsularis is widely distributed from the western parts of Lesotho and the south eastern and southern Orange Free State through the drier parts of the north east and eastern Cape as far east as Queenstown and the Fort Beaufort area and as far west as the Koudeveld Mountains west of Graaff Reinet and the Zuurberg north of Port Elizabeth at altitudes ranging from c. 180 to 1 800 m. It favours rocky places among grasses and shrubs, and appears to be more tolerant of dry conditions than any species save *D. integerrima*.

The more or less triangular leaves with a few sharp teeth nearly confined to the lower half of the margins give the species a characteristic facies. However, some forms of *D. integerrima* (specimens previously ascribed to

D. moltenensis and *Nemesia hastata*) strongly resemble *D. capsularis* in their vegetative parts (see further under *D. integerrima*). The two species may be distinguished by differences in corolla form: in *D. capsularis*, the corolla tube is invaginated, the two spurs are almost straight and curve away from each other, the palate is raised but there is no median keel, and the stamens project forward; in *D. integerrima* the corolla tube is not invaginated, the two spurs are strongly incurved at the extreme tips and lie close together and almost parallel, a strongly raised median keel lies between the entrances to the spurs, and the stamens stand erect with the anthers hidden inside the concave window.

The palate in *D. capsularis* is usually devoid of dark glands, but glands have been recorded on specimens over virtually the whole of the geographical range of the species. We are indebted to Mr. G. C. Matthews, Kirstenbosch, for flowers in spirit of two collections of *D. capsularis*: *Matthews 841* from Thaba Nchu Mountain in the south eastern Orange Free State has no glands on the palate, *Matthews 720* from near Grahamstown has dark short-stalked glands on the palate, reminiscent of the yellow glands on the keel in *D. rigescens*. Pressure has distorted the glands on most dried specimens, and it is not clear if the glands in *D. capsularis* are always short-stalked.

6. *Diascia barberae* Hook.f. in Bot. Mag. t. 5933 (1871); Wettstein in Engl. & Prantl., Pflanzenfam. 4 3B: 44 f.21 L (1897); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 156 (1904). Type: Bot Mag. tab. 5933; no specimen preserved.

Stoloniferous perennial herb, stems many from the crown, tufted, branching, up to 450 mm long, c. 2 mm diam., erect or decumbent, glabrous or nearly so becoming glandular-puberulous on the inflorescence branches. *Leaves* glabrous, mostly 10–25 × 5–20 mm (ratio 1–2:1), diminishing in size upwards, ovate or ovate-lanceolate, apex subacute, base somewhat rounded to almost truncate, margins serrate; petiole 1–5 mm long, the uppermost leaves nearly sessile. *Flowers* several to many in lax terminal racemes; bracts up to 6 × 4 mm, lanceolate, acute; pedicels mostly 11–30 mm long, ascending at an angle of c. 45°, glandular-puberulous, hairs scarcely 0.25 mm long, or sometimes wanting. *Calyx* segments lanceolate, two anticus ones c. 4 × 1.5 mm, three posticus ones slightly smaller, all green, thinly glandular-pilose or rarely glabrous. *Corolla* tube c. 5 mm long, shortly invaginated, two lateral spurs c. 7–8 mm long, directed out and down, tips slightly incurved, with a patch of dark sessile glands within; limb c. 23–27 × 20–24 mm, anticus lobe broadly ovate or subrotund, c. 11–13 × 13–16 mm, two lateral lobes ovate-oblong, c. 5–8 × 6–8 mm, two posticus lobes oblong-ovate, c. 4–7 × 4–6 mm, all lobes rose-pink, white patch at base of anticus lobe outside, all lobes thinly glandular-pilose outside, inside usually with two lateral

patches of dark gland dots on the outer face of the palate and extending briefly onto the anticus lobe, very rarely these two patches linking up (see below); "window" shallowly concave, the yellow portion fringed and blotched dark maroon. *Stamens* projecting forward from the base of the boss produced by the invaginated corolla tube; filaments c. 3.5 mm long, glandular-puberulous in upper part; anthers c. 0.5 mm long, cohering strongly, pollen yellow. *Ovary* c. 2×1.5 mm, deltoid in outline, ovules many in each loculus; style c. 2.5 mm long; stigma capitate, emerging from the centre of the anthers. *Capsule* c. $9-14 \times 5$ mm, urceolate; seeds c. 1.5 mm long, winged and ribbed. Fig. 4 e-h.

CITATIONS

NATAL—2929 (Underberg): Garden Castle Forest Reserve, valley beyond Forster's house (-CB), c. 1 980 m, 12/11/1980 [flowered later in cultivation], *Hilliard & Burt* 13470 (E, NU); Garden Castle Forest Reserve, Mlambonja valley, path to Mashai Pass (-CA), 2 195–2 285 m, 8/1/1982, *Hilliard & Burt* 15030 (E, NU).

LESOTHO—2828 (Bethlehem): Butha Buthe—Leribe distr., between Matsuka and Khube Rivers (-CC), 9200 ft., 13/1/1955, *Coetzee* 537 (PRE); Maseru distr., Lehaha-la-Sekhonyana (-AD), 9100 ft., 31/12/1946, *Jacot Guillarmod* 250 (PRE).

—2929 (Underberg): Mokhotlong distr., Mokhotlong (-AC), 3/1949, *Jacot Guillarmod* 1178 (PRE); Phutha, 10 000 ft., 26/2/1949, *Compton* 21574 (NBG); Sani Top (-CB), c. 2 900 m, 16/1/76, *Hilliard & Burt* 8832 (E, K, MO, NU, PRE); ibidem, 31/12/1973, *Hilliard* 5406 (E, NU); Qachas Nek distr., Machaba Peak (-CC), 21/3/1936, *Galpin* 13903 (BOL, K, PRE); Sehlabathebe National Park, c. 2 325 m, 16/2/1976, *Beverley* 511 (PRE); Quthing distr., Lake Letsie, 2 400 m, 11/12/1977, *Killick* 4393 (PRE).

Diascia barberae favours wet gravelly or silty places among rocks in the boulder beds of streams, in seepage areas, or on streamside banks, between c. 1 980 and 3 000 m. Herbarium records are scanty, but it appears to be widely distributed in the mountains of Lesotho, and has twice been found in stream valleys in the southern Natal Drakensberg.

When J. D. Hooker described *Diascia barberae* he wrote "The Royal Gardens are indebted to their highly-valued correspondent, Mrs. Barber, for seeds of this plant, which arrived in 1870, and flowered in July of the present year" [1871]. Mrs. Barber lived for many years in the eastern Cape and it has been tacitly accepted that *D. barberae* is an eastern Cape plant. The distinguishing characters of *D. barberae* are clearly shown in Hooker's plate, which is the type of the name: the shape of the spurs, the two lateral patches of gland dots on the palate, the four equal stamens, the shape of the window. All the wild material matching the plate has been collected in Lesotho and the southern Natal Drakensberg. Mr. N. Hepper consulted the Kew archives for us and found that Mrs. Barber wrote to Kew on 15 November 1869 "my brother has just sent a small packet of seeds from Basutoland for

you and I shall forward them at the same time as I do this letter". We correlate this letter with eighteen packets of seed from Mrs. Barber, marked Basutoland, accessioned in the Garden on 12 May 1870. Col. Bowker, Mrs. Barber's brother, was Agent in Basutoland for the Governor at the Cape between 1868 and 1870, and lived in Maseru.

The two patches of glands on the palate are usually well-separated, but occasionally they can partially link up: *Matthews 1003*, NU (Lesotho 2928 CA between Mantsonyana and Likalaneng, 2 000 m) may have the patches either well-separated or linked by a few glands while in *Matthews 881*, NBG (Lesotho 2928 BB, \pm 23 km from Mothae turnoff towards Masoleng, 2 750 m) the patches have partially coalesced. Mr. Matthews sent flowers in spirit as well as dried specimens, and there is no doubt about the identity of his 881.

7. *Diascia tugelensis* Hilliard & Burt in Notes R. bot. Gdn Edinb. **41**: 313 (1983). Type: Natal, Bergville distr., 2828 DB, Royal Natal National Park, Tugela gorge, Sentinel gully, 1 800 m, 6/2/1982 [sterile; flowered in cult. 5 1982], *Hilliard & Burt 15455* (E, holo.; NU, iso.).

Stoloniferous perennial herb, stems many from the crown, tufted, branching, up to c. 450 mm long, c. 2 mm diam., decumbent, rooting near the base, glabrous, becoming glandular-puberulous only on the inflorescence branches. *Leaves* mostly 8–25 \times 6–15 mm (ratio 1–1.5:1), ovate, apex subacute, base subcordate, margins serrate, glabrous; petioles 3–10 mm long. *Flowers* few to several in lax terminal racemes; bracts up to 7 \times 4 mm, lanceolate, margins serrate, a few gland-tipped hairs often present; pedicels c. 25–50 mm long, spreading at an angle of c. 90°–45°, glandular-puberulous, hairs scarcely 0.25 mm long. *Calyx* segments lanceolate, reflexed, two anticus ones 3–4 \times 1.5–1.75 mm, three posticus ones slightly smaller, all green, glandular-puberulous. *Corolla* tube c. 5–6 mm long, invaginated, two lateral spurs 5–7 mm long, curved forward, with a patch of dark globular sessile glands within at the swollen tips; limb c. 20–23 \times 18–20 mm, anticus lobe c. 9–11 \times 10–11 mm, two lateral lobes 5.5–7 \times 5–7 mm, two posticus lobes 4–5 \times 5 mm, all lobes suborbicular, rose-pink sparsely glandular-pilose outside, palate without dark sessile gland dots, deeply channelled down the back and along the floor of the tube to accommodate the filaments, the "window" concave, c. 1.5 mm deep, yellow and maroon. *Stamens* projecting forward from the base of the boss produced by the invaginated corolla tube; filaments c. 4 mm long, glandular-puberulous; anthers c. 1.25 mm long, cohering strongly, pollen yellow. *Ovary* c. 1.5–2 \times 1–1.5 mm, deltoid in outline, ovules many in each loculus; style 2.75–3 mm long; stigma capitate, lying between the anthers. *Capsule* (5–)9–14 \times 4–5

mm, oblanceolate in outline; seeds 1.25 mm long, narrowly winged, not ridged. Fig. 5 a-d.

CITATIONS

ORANGE FREE STATE—2828 (Bethlehem): Witzieshoek, The Sentinel (-DB), 11000 ft., 15/4/1951, *Steyn 1080* (NBG); Mont-aux-Sources, 8000 ft., 4/1913, *Dyke 5452* (NBG); The Witches (north side) near The Sentinel, 8200 ft., 3/3/1976, *Rourke 1520* (NBG); *ibidem*, 14/1/1982, *Matthews 746* (NBG); N W side of The Sentinel, 15/1/1982, *Matthews 760* (NBG, NU); W-facing slopes of The Sentinel, 14/1/1982, *Roux 1090* (NU).

NATAL—2828 (Bethlehem): Bergville distr., Mont-aux-Sources, near hut (-DD), 9900 ft., 19/3/1946, *Schelpé 1340* (NH, NU); National Park, 2/1927, *Prescott-Decie s.n.* (BOL).

Diascia tugelensis has been recorded from the Drakensberg near the sources of the Tugela river, between c. 1 800 and 3 000 m above sea level. At higher altitudes, the plants grow in the crevices and along the foot of wet basalt cliffs, but Schelpé recorded it near rock flushes and along stream-banks on the bleak plateau below the summit of Mont-aux-Sources, while we found it in wet gravel in the rocky streambed of Sentinel gully at its confluence with the gorge of the Tugela.

Diascia tugelensis is allied to *D. vigilis* with which it is sympatric, and they may occupy similar habitats, but living plants are easily distinguished because the corolla of *D. tugelensis* lacks dark sessile glands on the palate, which is channelled, so that the filaments project forward along this groove; in *D. vigilis* the palate is raised, not grooved, and a patch of dark glands lies on the face of this hump. Also, in *D. tugelensis* the corolla tube is sufficiently invaginated to push the calyx lobes back into the reflexed position; in *D. vigilis*, the calyx lobes lie flat against the back of the corolla because the tube is scarcely invaginated. In no species other than *D. tugelensis* have we seen spurs with remarkably swollen tips. Another peculiar character is its susceptibility to infestation by red mites, and the damage they do can often be detected in dried specimens. The rather small leaves, long nude peduncles, and well-spaced flowers on long spreading pedicels impart a characteristic facies.

8. *Diascia vigilis* Hilliard & Burtt in Notes R. bot. Gdn Edinb. **41**: 313 (1983). Type: Orange Free State, Witzieshoek, road to The Sentinel, c. 2 440 m, 27/12/1975, *Hilliard & Burtt 8656* (E, holo.; K, MO, NU, PRE, iso.).

Stoloniferous perennial herb, stems many from the crown, tufted, branching, up to c. 500 mm long c. 2 mm diam., decumbent or suberect, often straggling, nearly glabrous to sparsely glandular-pilose, the hairs

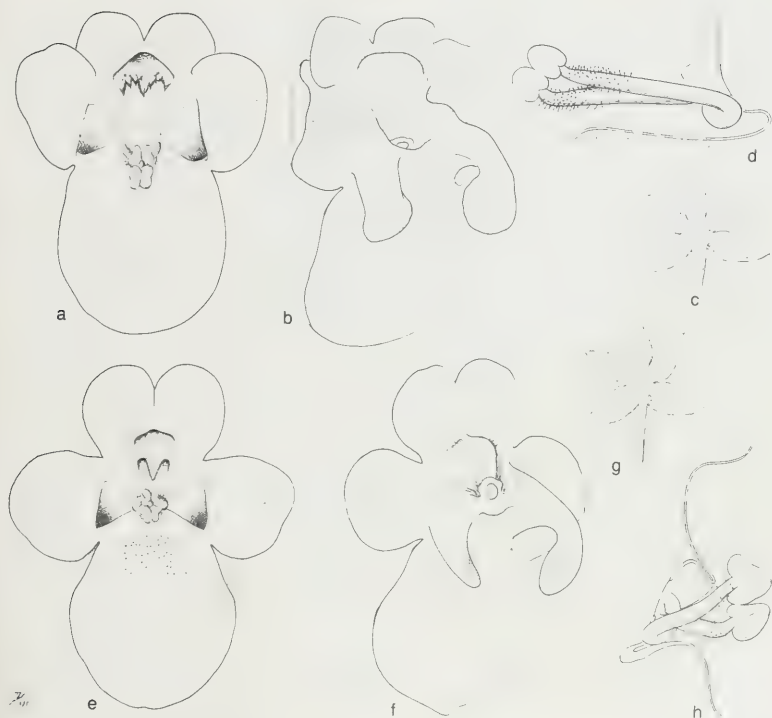


FIG. 5.

Diascia tugelensis (Hilliard & Burt 15455); a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, stamens ($\times 6$). *D. vigilis* (Hilliard & Burt 11957); e, corolla, front view ($\times 2.5$); f, corolla, back view ($\times 2.5$); g, calyx ($\times 2.5$); h, stamens ($\times 6$).

patent. *Leaves* either glabrous or thinly glandular-pilose, mostly $15-50 \times 10-35$ mm (ratio 1-2:1), ovate or ovate-lanceolate, apex subacute, base \pm rounded, margins sharply serrate, petiole 2-10 mm long, glabrous or glandular-hairy. *Flowers* few to many in lax terminal racemes; bracts up to 12×10 mm, but mostly much smaller, ovate-lanceolate, very acute to shortly acuminate, thinly glandular-pilose; pedicels mostly 14-25 mm long, sharply ascending, thinly glandular-pilose, the hairs c. 0.5 mm long. *Calyx* segments spreading, lanceolate, two anticus segments $3.5-5 \times 1.75-2$ mm, three posticus ones slightly smaller, all green with spreading gland-tipped hairs

outside. *Corolla* tube c. 5–6 mm long, scarcely invaginated, two lateral spurs c. (6–)7–9 mm long, curved out, down and slightly forward, with a patch of dark sessile glands within, limb c. 22–28 × 17–23 mm, anticus lobe elliptic-ovate, 10–13 × 11–15 mm, two lateral lobes subrotund or elliptic-oblong, 5–7 × 7–8,5 mm, two posticus lobes subrotund or elliptic-oblong, 4,5–7 × 4,5–6, all rose-pink, sparsely glandular-pilose outside, inside with a broad inverted V of dark sessile glands centrally placed on the raised palate, very rarely these glands wanting, the “window” concave, c. 1–1,5 mm deep, yellow and maroon. *Stamens* projecting forward; filaments 3 mm long, sparsely glandular-pubescent in the upper half, anthers 1–1,5 mm long, cohering strongly, pollen yellow. *Ovary* 1,5–2 × 1–1,25 mm, deltoid in outline; ovules many in each loculus; style c. 2 mm long, stigma capitate, emerging from the centre of the anthers. *Capsules* (6–)7–11 mm long, urceolate; seeds 1,25 mm long, curved, winged and ridged. Fig. 5 e–h.

SELECTED CITATIONS

ORANGE FREE STATE—2828 (Bethlehem): Witzieshoek, Caledon Pass (-DB), 2 400 m, 12/1895, *Thode* 40 (BOL, K); North slopes of The Sentinel near chain ladder, 9000 ft., 3/3/1976, *Rourke* 1523 (K, NBG, PRE); NW slopes of The Pudding, 8000 ft., *Rourke* 1536 (K, NBG); Footpath to base of Sentinel, 9200 ft., 2/2/1982, *Stewart & Manning* 2244 (E, NU); Between The Pudding and The Dome, 16/1/1982, *Matthews* 748 (NBG); Between The Sentinel and chain ladder, 15/1/1982, *Matthews* 759 (NBG); ibidem, 14/1/1982, *Roux* 1106 (E, NU). —2829 (Harrismith): Platberg (-CA), *Sankey* 198 (K); ibidem, 9/1981, *Roux* 1255 (E, NU).

NATAL—2828 (Bethlehem): Bergville distr., Royal Natal National Park, path to Tugela gorge (-DB), c. 1 800 m, 23/3/1981, *Hilliard & Burt* 14450 and 14451 (E, NU); ibidem, 20/2/1928, *Lewis Grant* 3620 (BOL, GRA, K, PRE); ibidem, Devil's Hoek, c. 5800 ft., 13/2/1928, *Galpin* 10175 (K, PRE); ibidem, Mahai Valley, 26/4/1951, *Vogel* 272 (PRE); The Cavern, 5800 ft., 1/1956, *Pascoe* 2 (NU).

—2829 (Harrismith): Cathedral Peak, Umlambonja Valley (-CC), 5600 ft., 8/1/1965, *Schelpé* 7186 (BOL); ibidem, Umhlwasine River, 4000 ft., 12/1949, *Slinger* 9 (NH, NU); ibidem, MnWeni area, 7000 ft., 7/1973, *Esterhuysen* 21675 (BOL, PRE); ibidem, stream tributary to the Tsekeseke, 2 100 m, 18/1/1983, *Hilliard & Burt* 16285 (E, NU).

LESOTHO—2828 (Bethlehem): Leribe distr., Malavaneng (-CC), 5–6000 ft., 2/1913, *Dieterlen* 874 (PRE, SAM).

Diascia vigilis derives its epithet from The Sentinel (lat. *vigil*), the huge basalt block on the northern end of The Amphitheatre wall that towers over Royal Natal National Park, and many of the collections of this species come from the much-visited valley of the Tugela river and its tributaries below The Ampitheatre and from the path leading past The Sentinel to Mont-aux-Sources, but there are also several records from the Cathedral Peak area further south, and one from Leribe in western Lesotho. There are also two records from Platberg, the great basalt-capped mountain lying on top of the

low Drakensberg at Harrismith in the north eastern Orange Free State, just north of Mont-aux-Sources and the high Drakensberg massif. Mr. J. P. Roux's specimen from Platberg, which was supplemented with flowers in spirit, differs very slightly from specimens from the high Drakensberg: the spurs are a little shorter (as though the tips had atrophied) and there are no gland dots on the palate; however, Sankey 198, also from Platberg, has spurs of normal length and an ill-developed patch of glands on the palate.

At lower altitudes, *D. vigilis* may be found on damp banks on the edges of forest patches and in the shelter of large rocks along the margins of small mountain streams; at higher altitudes it grows in the shelter of moist cliffs, among big rocks. It forms large tangled clumps, and sometimes scrambles up through bushes. There is remarkable variation in the degree of hairiness of the stems and leaves, and nearly glabrous and pilose forms may grow intermingled.

Diascia fetcaniensis, from the southern end of the Drakensberg, shows similar variation in hairiness. Care is needed to distinguish the two species, but in *D. vigilis* the calyx lies flat against the back of the corolla because the corolla tube is scarcely invaginated (it is bent in then out again, like a half-turned glove); in *D. fetcaniensis* the corolla tube is strongly invaginated, so that the calyx segments are reflexed. This distinction is not easy to detect in dried material unless the corollas have been carefully pressed, but the shape of the window differs in the two species (see Figs 5 and 6) and the filaments are glandular-pubescent in *D. vigilis*, not glandular-pilose.

Diascia vigilis is frequently misidentified in herbaria as *D. barberae*, but that species can be distinguished by the two lateral patches of gland dots on the palate and the more deeply invaginated corolla tube, which forces the calyx segments to reflex.

9. *Diascia* sp.

Perennial herb, stems many from the crown, tufted, simple, up to c. 300 mm long, 2 mm diam., probably weakly erect, glabrous. *Leaves* c. 11–16 × 7–14 mm (ratio c. 1:1), ovate, base ± cordate, apex acute to obtuse, margins serrate, whole leaf glabrous; petioles 1–3 mm long. *Flowers* several to many in a lax terminal raceme; bracts up to 8 × 4 mm, lanceolate, acuminate, glandular-pubescent; pedicels c. 13–20 mm long, filiform, ascending at an angle of c. 45°, they and the axis of the inflorescence glandular-pubescent, hairs patent, less than 0.25 mm long. *Calyx* segments lanceolate, two anticus ones 4–5 × 1.5 mm, three posticus ones slightly smaller, glandular-pubescent. *Corolla* tube c. 4 mm long, possibly scarcely invaginated, two lateral spurs c. 4 mm long, probably directed downwards and ± straight, tips with dark sessile glands within; limb c. 13–15 × 12–

13 mm, anticus lobe c. $6-8 \times 7-9$ mm, lateral lobes c. 5×5 mm, posticus lobes c. $2,5 \times 3$ mm, all subrotund, pink, with scattered glandular hairs outside, glabrous inside except for a patch of dark sessile glands centrally placed on the palate; "window" shallowly concave, yellow. *Stamens* with filaments 2 mm long, glandular-pubescent; anthers 0,75 mm long, cohering. *Ovary* $1,5 \times 1$ mm, deltoid in outline; style 1,5 mm long, stigma capitate, lying between the anthers. *Capsules* not seen.

CITATION

TRANSKEI—3127 (Lady Frere): Engcobo distr., hills near Engcobo (-DB), 13/10/1961, *Esterhuysen* 29250 (BOL).

This plant is in the general affinity of *D. fetcaniensis* and *D. stachyoides*, from which it differs at least in indumentum and in the shallow window; *D. barberae* has similar short glandular hairs on the pedicels, but in that species the glands on the palate are in two discrete patches laterally placed, and the whole facies is different. Formal description must wait upon further collections, including flowers in spirit.

GROUP 3

10. *Diascia stricta* Hilliard & Burt in Notes R. bot. Gdn Edinb. **41**: 313 (1983). Type: E Cape, 3027 DC, Barkly East distr., Witteberg, river below "Pitlochrie", c. 1 770 m, 4/12/1981, *Hilliard & Burt* 14705 (E, holo.; NU, iso.).

Rhizomatous perennial herb, stems several from the crown, tufted, simple, or sparingly branched, up to 500 mm long, c. 2 mm diam., glandular-pilose, the hairs patent. *Leaves* often sharply ascending, mostly $10-15 \times 4-8$ mm, (ratio c. 2:1), diminishing in size upwards, ovate-lanceolate, apex subacute, base subcordate, margins serrate particularly in lower half, both surfaces glandular-pilose; petioles 1-2 mm long, uppermost leaves almost sessile. *Flowers* many in crowded terminal racemes or panicles; bracts up to 5×4 mm, lanceolate, acute; pedicels c. 10-15 mm long, ascending at an angle of c. 45° , nearly glabrous to sparsely glandular-pilose, hairs c. 0,25-0,5 mm long. *Calyx* segments lanceolate, two anticus ones c. $2-2,5 \times 1-1,25$ mm, three posticus ones slightly smaller, all green, glabrous to glandular-pilose only in lower half. *Corolla* tube 2,5-3 mm long, invaginated, two lateral spurs c. 4 mm long, strongly curved forward, tips with dark globular sessile glands within, limb c. $15-20 \times 12-15$ mm, anticus lobe subrotund, c. $8-9 \times 8-11$ mm, two lateral lobes oblong-ovate, c. $3-4 \times 5$ mm, two posticus lobes oblong-ovate, c. $2,5-3 \times 3-4$ mm, all lobes rose-pink, thinly glandular-pilose outside, without dark sessile glands

on upper surfaces of lobes; palate slightly raised with two channels running back down the floor of the corolla tube in which the filaments lie; "window" deeply concave, drawn out into a short cone c. 1–2 mm deep, yellow and maroon. *Stamens* projecting forward from the base of the boss produced by the invaginated corolla tube; filaments c. 2,75 mm long, shaggy with long delicate gland-tipped hairs; anthers c. 0,75 mm long, cohering strongly, pollen yellow. *Ovary* c. $1,25 \times 1$ mm, deltoid in outline, ovules many in each loculus; style 2,25 mm long, stigma capitate, emerging from the centre of the anthers. *Capsule* c. $5-8 \times 3-4$ mm, lanceolate in outline; seeds c. 1,25 mm long, narrowly winged, ribbed. Fig. 6 a–d.

CITATIONS

CAPE—3025 (Colesberg): Colesberg distr., Joubert (-CA), 1/1925, *Thode* A502 p.p. (PRE).

—3027 (Lady Grey): Barkly East distr., between Naude's Nek and Ben Mcdhui (-DB), 8000–8500 ft., 21/1/1982, *Matthews* 842 (NBG, NU); ibidem, 19/1/1982, *Matthews* 203 (NBG); Ben Mcdhui, c. 2 560 m, 3/2/1983, *Hilliard & Burt* 16374 (E, NU).

—3028 (Matatiele): Maclear distr., southern side of Naude's Nek Pass (-CA), 8000 ft., 19/1/1982, *Matthews* 802 (NBG, NU); Barkly East distr., Rhodes to Naude's Nek (-CA/-CC), 13/2/1983, *Hilliard & Burt* 16589 (E, NU); Klopershoek Valley NE of Rhodes (-CA), c. 2 070–2 200 m, 14/2/1983, *Hilliard & Burt* 16631 (E, NU).

Diascia stricta is known from a limited area of the north eastern Cape, from about Colesberg (S $30^{\circ} 42'$ E $25^{\circ} 10'$) to the Cape Drakensberg and Witteberg (c. S $30^{\circ} 40'$ E 28°). The stems of the initial material that we saw seemed to be rather stiffly erect, and suggested the trivial name; however, subsequent field work has shown that the plants may have decumbent and rather straggling stems particularly when they grow up through grass tufts or bushes. The species is found on mountain slopes and tops from c. 2 000 to 2 600 m above sea level, sometimes on streambanks or in drainage lines, sometimes in montane scrub where the soil is usually moist.

Diascia stricta is easily recognised by its small ovate-lanceolate leaves (*D. integerrima* may have similar leaves, but they are always glabrous, not hairy). It can be distinguished from its close ally, *D. fetcaniensis*, not only by the leaves (mostly 4–8 mm broad, not 15–25 mm), but also by the smaller flowers (limb c. 15–20 mm long, not 20–24 mm) and the lack of any dark gland dots on the palate (not a centrally placed patch that is only very rarely wanting).

11. *Diascia fetcaniensis* Hilliard & Burt, species nova; *D. stachyoidei* Hiern affinis sed calcaribus valde introrsum curvatis (nec extrorsum deinde deorsum, apicibus ipsis leviter incurvis), fenestra conica basi latiore (4–5 mm, nec 2,5–3 mm), filamentis longioribus (3–4 mm, nec 2,5 mm) distinguitur.

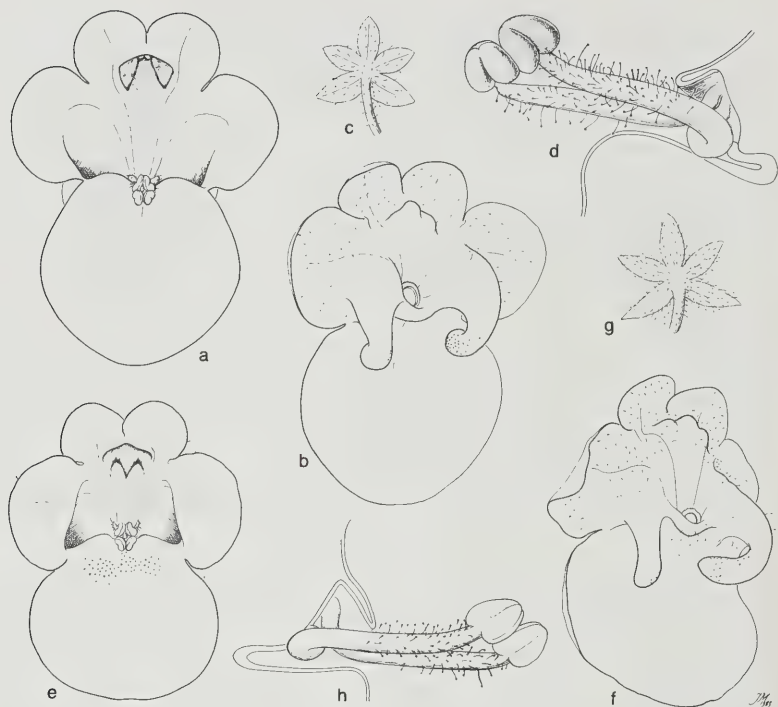


FIG. 6.

Diascia stricta (Hilliard & Burt 16589); a, corolla, front view ($\times 3,5$); b, corolla, back view ($\times 3,5$); c, calyx ($\times 2,5$); d, stamens ($\times 15$). *D. fetcaniensis* (Hilliard & Burt 12318); e, corolla, front view ($\times 2,5$); f, corolla, back view ($\times 2,5$); g, calyx ($\times 2,5$); h, stamens ($\times 10$).

Herba perennis, stolonifera; caules e summo caudice numerosi, caespitiosi, ramosi, usque ad 400 mm longi, c. 2 mm diam., decumbentes vel suberecti, pilis mollibus patentibus glandulosis praediti. *Folia* plerumque $15-24 \times 15-25$ mm, ratione 1-1,5:1, ovata, basi \pm cordata, apice acuto vel rotundato, marginibus serratis, utrinque pilis longis glandulosis patentibus induta vel pilis parvis vel absentibus; petioli 1-7 mm longi, glanduloso-pilosi vel glabri. *Flores* plures vel numerosi in racemos laxos terminales dispositi; bracteae plerumque 7×7 mm usque, a foliis bene distinctae vel interdum infima foliaceae, ovata-cordatae, glandulosae; pedicelli 15-25 mm longi,

glanduloso-pilosi, pilis 0,5 mm longis. *Calyx* 5-partitus; segmenta lanceolata, reflexa, 2 antica c. $3-6 \times 1-1,5$ mm, 3 postica paulo minora, omnia viridia, extra patenter glanduloso-pilosa. *Corolla* tubo c. 4-5 mm longo valde invaginato; calcar 5-7 mm longa, valde prorsum curvata, intus ad apices glandulis fuscis praediti; limbus c. $20-24 \times 15-21$ mm, roseus, extra parce glanduloso-pilosus, intus glandulis fuscis sessilibus in palato transverse dispositis, glandulis raro absentibus; fenestra concava conum 1,5-2,5 mm altum basi 4-5 mm diam. formans. *Stamina* 4, aequalia, porrecta; filamenta 3-4 mm longa, glanduloso-pilosa; antherae c. 0.75-1 mm longae, inter se valde cohaerentes, polline luteo. *Ovarium* 1,5-2 \times 1-1,5 mm; ovula in quoque loculo numerosa; stylus 2-3 mm longus, stigmatibus capitatis inter antheras positus. *Capsula* 7-12 \times 3,5-4 mm, urceolata; semina 1,5 mm longa, alata et costata.

Type: E Cape, 3127 BB, Barkly East distr., Fetcani Pass, c. 2 285-2 300 m, 22/1/1979, Hilliard & Burt 12318 (E, holo.; NU, iso.).

Stoloniferous perennial herb, stems many from the crown, tufted, branching, up to c. 400 mm long, c. 2 mm diam., decumbent or suberect, softly pilose, hairs patent, gland-tipped. *Leaves* mostly 15-24 \times 15-25 mm, rarely much smaller or much larger, ratio 1-1,5:1, ovate, base \pm cordate, apex obtuse to rounded, margins serrate, both surfaces with long patent gland-tipped hairs or hairs sparse or wanting; petioles 1-7 mm long, glandular-pilose to glabrous. *Flowers* several to many in lax terminal racemes; bracts mostly up to 7 \times 7 mm, usually sharply differentiated from the leaves, the lowermost occasionally leaf-like, ovate-cordate, glandular; pedicels 15-25 mm long, ascending at angle of c. 45°-90°, glandular-pilose, hairs mostly 0,5 mm long. *Calyx* segments lanceolate, reflexed, two anticus ones c. $3-6 \times 1-1,5$ mm, three posticus ones slightly smaller, all green, pilose outside with patent gland-tipped hairs. *Corolla* tube c. 4-5 mm long, strongly invaginated, two lateral spurs c. 5-7 mm long, strongly curved forward, with a patch of dark sessile glands within at the tips; limb c. $20-24 \times 15-21$ mm, anticus lobe broadly ovate, c. $10-14 \times 10-13$ mm, two lateral lobes subrotund, c. $5-6 \times 5,5-7$ mm, two posticus lobes subrotund, c. $5-6 \times 4-5$ mm, all lobes rose-pink, sparsely glandular-pilose outside, inside usually with, rarely without, a transversely elongated central patch of dark sessile glands on the front of the palate, which is channelled down the back to accommodate the forward thrust of the invaginated corolla tube, the "window" concave, forming a small conical spur 1,5-2,5 mm deep, 4-5 mm across at the base, yellow and maroon. *Stamens* projecting forward from the base of the boss formed by the invaginated corolla tube: filaments 3-4 mm long, glandular-pilose; anthers c. 0.75-1 mm long, cohering strongly, pollen

yellow. Ovary $1.5-2 \times 1-1.5$ mm, deltoid in outline, ovules many in each loculus; style 2-3 mm long, stigma capitate, lying in the centre of the anthers. Capsule 7-12 \times 3.5-4 mm, urceolate; seeds 1.5 mm long, curved, winged and ridged. Fig. 6 e-h.

CITATIONS

CAPE—3027 (Lady Grey): Barkly East distr., Ben Mcdhui (-DB), c. 9900 ft., 11/3/1904, *Galpin 6783* (PRE); ibidem, 8500 ft., 19/1/1982, *Matthews 804* (NBG); ibidem, c. 2560 m, 3/2/1983, *Hilliard & Burt 16375* (E, NU); ibidem, 19/1/1982, *Roux 1175* (NU); Between Ben Mcdhui and Naude's Nek, 19/1/1982, *Roux 1176* (NU); Naude's Nek summit, 18/1/1982, *Roux 1155* (NU).

—3028 (Matatiele): Maclear distr., Naude's Nek (-CA), c. 1980 m, 9/4/1966, *Hilliard 3935* (E, NU); Between Rhodes and Maclear at 51 and 54 km from Maclear (-CD), 5500 ft., 20/1/1982, *Matthews 809* (NBG); Near Elands Heights, 19/1/1982, *Roux 1190* (NBG); Pot River Berg, 5500 ft., 20/3/1904, *Galpin 6785* (BOL, GRA, K, NH, PRE); Tsitsa footpath, c. 7600 ft., 20/3/1904, *Galpin 6784* (BOL, GRA, K, NH, PRE).

—3127 (Lady Frere): Barkly Pass, Kraalberg (-BB), 7000 ft., *Rattray sub Galpin 7310* (PRE); Elliot distr., Bastervoetpad, c. 2 200 m, 15/2/1983, *Hilliard & Burt 16700* (E, NU); ibidem, 19/2/1983, *Batten 647* (E, NU); ibidem, 7500 ft., 21/1/1983, *Matthews 828* (NBG), 827 (NBG, NU), 824 (NBG).

LESOTHO—3028 (Matatiele): Quthing distr., Buffalo River waterfall (-CA), c. 8200 ft., 14/3/1904, *Galpin 6781* (K, PRE).

TRANSKEI—3028 (Matatiele): Ongeluk's Nek, \pm 4 km from Lesotho border post (-AD), 2 000 m, 14/1/1983, *Matthews 917* (NBG); Qacha's Nek, \pm 1 km from border post (-BA), 1 750 m, 16/1/1983, *Matthews 950* (NBG).

Diascia fetcaniensis has been recorded from Qacha's Nek and Ongeluk's Nek on the Transkei-Lesotho border, Ben Mcdhui, the Buffalo River waterfall and Naude's Nek on the Cape-Lesotho border along the Cape Drakensberg and its foothills to about Barkly Pass, at altitudes ranging from 1 675 to 3 000 m. It favours damp places at the foot of cliffs or grassy banks along streams, sometimes heavily shaded by trees and bushes; or it may grow in the shelter of large grass tussocks on the more exposed tops of the mountains.

Diascia stachyoides and *D. stricta* are the two species that are more or less sympatric with *D. fetcaniensis* and with which it is most likely to be confused. It can be distinguished from *D. stachyoides* by its differently shaped lateral spurs (strongly curved inwards, not directed out then down, incurved at the tips only), by the width of the window cone (4-5 mm at the base, not 2.25-3 mm) and by the length of the filaments (3-4 mm, not 2.5 mm). The characters that distinguish *D. stricta* are enumerated under that species.

12. ***Diascia stachyoides*** Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 160 (1904). Type: Cape, Queenstown distr., Hangklip Mountain, base of cliff on summit, 6300 ft., March 1893, *Galpin 1520* (K, holo.; BOL, GRA, iso.).

D. flanaganii Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 161 (1904). Type: Cape, between Elliot and Maclear, *Flanagan s.n.* (K).

Stoloniferous perennial herb, stems many from the crown, tufted, branching, up to c. 400 mm long, 2 mm diam., decumbent or suberect, softly glandular-pilose, hairs patent. *Leaves* mostly $10-25 \times 8-25$ mm in the proportion 1-1.5:1, diminishing in size upwards, ovate, base \pm cordate, apex obtuse to rounded, margins serrate, both surfaces glandular-pilose; petioles 1-3.5 mm long, glandular-pilose. *Flowers* several to many in lax terminal racemes, bracts up to 10×12 mm, many of them leaf-like, ovate-cordate, glandular-pilose; pedicels c. 14-26 mm long, ascending at an angle of $45^\circ-90^\circ$, filiform, glandular-pilose, hairs patent, mostly at least 0.5 mm long. *Calyx* segments lanceolate, reflexed, two anticus lobes $3-5 \times 1.25-1.5$ mm, three posticus lobes slightly smaller, all green, pilose outside with patent gland-tipped hairs. *Corolla* tube c. 4 mm long, strongly invaginated, two lateral spurs c. 4-7 mm long, directed out, then down, slightly incurved at the tips, tips with dark sessile glands within; limb c. $17-19 \times 16-18$ mm, anticus lobe $7.5-10 \times 10-11$ mm, subrotund, two lateral lobes c. 5×7 mm, subrotund, two posticus lobes c. 4×5.5 mm, subrotund; all lobes rose-pink, sparsely glandular-pilose outside, either glabrous inside or with a few dark sessile glands centrally placed on the palate, which has a double groove down the back to accommodate the filaments, the "window" deeply concave, forming a small hollow cone 1.5-3.75 mm long, 2.25-3 mm across at the base, yellow and maroon part mostly hidden within the cavity. *Stamens* projecting forward from the base of the boss formed by the invaginated corolla tube; filaments 2.5 mm long, glandular-pilose; anthers 0.75 mm long, cohering strongly, pollen yellow. *Ovary* $1.5-1.75 \times 1-1.5$ mm, deltoid in outline, ovules many in each loculus; style 1.5 mm long, stigma capitate, lying in the centre of the anthers. *Capsules* not seen. Fig. 7 a-d.

CITATIONS

CAPE—3126 (Queenstown): Hangklip Mountain (-DD), 1/1962, *Koopowitz s.n.* (PRE); ibidem, 6600 ft., 31/12/1962, *Roberts 2006* (PRE).

—3127 (Lady Frere): Barkly Pass (-BD), 1980 m. 29/11/1981, *Hilliard & Burt 14554* (E, NU)

LESOTHO—3028 (Matatiele): Qacha's Nek (-BA), 26/1/1938, *Fawkes 339* (PRE).

Diascia stachyoides has been recorded from only three localities in the north eastern Cape and nearby Lesotho. On Hangklip Mountain it is reported to grow at the base of the summit cliffs at an altitude of c. 1 950 m, while we found it in the shelter of large grass tussocks in a stream gully on Barkly Pass, at much the same altitude. These are precisely the habitats favoured

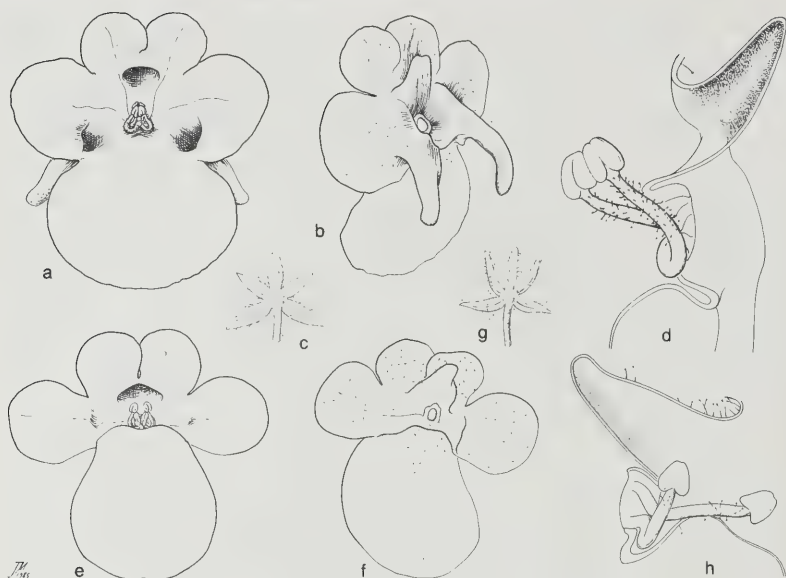


FIG. 7.

Diascia stachyoides (Hilliard & Burt 14554); a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, stamens, and cone in section ($\times 7.5$). *D. lilacina* (Hilliard & Burt 12297); e, corolla, front view ($\times 4$); f, corolla, back view ($\times 4$); g, calyx ($\times 4$); h, 2 stamens, cone and corolla base in section ($\times 10$).

by its close ally, *D. fetcaniensis*, which is known from the Cape Drakensberg and the nearby Witteberg and mountains in Lesotho.

Hiern described *D. flanaganii* as having "two obtuse spurs or pouches about $\frac{1}{10}$ " long". The type material at Kew is only a scrap of stem bearing buds, and it is clear that Hiern measured the tips of the infolded spurs, which are exactly 2 mm ($\frac{1}{10}$ "') long. The specimen has the same leaf-like bracts as *D. stachyoides*, no sessile glands on the palate, and resembles *D. stachyoides* in all other respects; we judge them to be conspecific.

The leafy inflorescence gives *D. stachyoides* an easily recognisable facies; only *D. lilacina* has a similar inflorescence, and that species is easily recognised by its much smaller lilac-coloured flowers without lateral spurs. The leaf-like bracts may be poorly developed in depauperate specimens of *D. stachyoides*, and then the species with which it is probably most easily confused is *D. fetcaniensis*, which has differently shaped spurs, a broader window cone, and longer filaments and style (see under *D. fetcaniensis*).

13. *Diascia lilacina* Hilliard & Burt in Notes R. bot. Gdn Edinb. **41**: 312 (1983). Type: Cape, 3127 A-B border, Barkly East—Elliot distr. boundary, Saalboom Nek south of Clifford, c. 2 100 m, 21/1/1979, Hilliard & Burt 12297 (E, holo.; NU, iso.).

Perennial herb, stems many from the crown, of indeterminate length, c. 2 mm diam., creeping, rooting, branching, glandular-pilose. *Leaves* c. 7–25 × 7–25 mm (ratio 1:1), diminishing in size upwards, ovate, apex obtuse, base cordate, margins serrate, both surfaces glandular-pilose; petiole c. 3 mm long, glandular-pilose. *Flowers* solitary in the upper leaf axils forming a long leafy raceme; pedicels filiform, c. 6–10 mm long, spreading, or reflexed in fruit, brownish-green, glandular-pilose, hairs at least 0.5 mm long. *Calyx* segments linear-lanceolate, two anticus lobes c. 2.5 × 0.75 mm, three posticus ones slightly smaller, all green, glandular-pilose. *Corolla* tube c. 2 mm long, not invaginated, with two very shallow pouches at base of lateral corolla lobes, the posticus yellow and maroon “window” produced into a hollow cone c. 2.5–3 mm long; limb c. 12 × 11 mm, anticus lobe oblong-elliptic, c. 8 × 6 mm, two lateral lobes subrotund, c. 3.5 × 3 mm, two posticus lobes oblong-elliptic, c. 2.5 × 2.5 mm, all lilac-pink, sparsely glandular-pilose outside, glabrous inside, without dark sessile glands on the palate, which is strongly raised transversely with a median groove to accommodate the filaments of the posticus pair of stamens. *Stamens* unalike, anticus pair erect, filaments c. 1 mm long, glabrous or with a few gland-tipped hairs, anthers c. 0.75 mm long, not cohering, pollen grey-green; posticus pair projecting straight forward, filaments 1.5 mm long, minutely glandular-puberulous, anthers c. 0.75 mm long, cohering strongly, pollen grey-green. *Ovary* c. 0.75 × 0.5 mm, deltoid in outline, ovules two in each loculus; style 1.5 mm long, projecting straight forward above the posticus stamens, stigma capitate. *Capsule* c. 2 × 3 mm, subrotund, apex beaked; seeds c. 2 mm long, testa raised-reticulate. Fig. 7 e–h.

CITATION

CAPE—3127 (Lady Frere): Barkly East—Elliot distr. boundary, Saalboom Nek (-AB), c. 7200 ft., 15/11/1959, Acocks 20204 (PRE).

Diascia lilacina is known only from the cliffs at the summit of Saalboom Nek Pass on the road from Barkly East to Elliot via Clifford. The colour of the flowers, lilac-pink, is unusual in the genus, but the most extraordinary feature of the corolla is the production of the window into a long hollow cone and the absence of lateral spurs. A similar elongation of the window occurs in *D. stachyoides* (which also has a similar leafy inflorescence) and *D. fetcaniensis*, but both these species have, in addition, two lateral spurs: in

D. lilacina two very shallow lateral pouches occur in place of spurs, and these are devoid of dark sessile glands. The flowers are exceptionally small too, being matched in size only by those of *D. personata*, which also has a very odd corolla, but quite different from that of *D. lilacina*, and sometimes by those of *D. rigescens*, which again differs markedly in corolla form. The arrangement of the stamens in *D. lilacina* is not unlike that in *D. purpurea* and its two allies, where a pair of staminodes or reduced stamens stand erect, and a pair of fully fertile stamens project forward; however, in *D. lilacina* the anthers are all alike, and all produce grey-green pollen.

GROUP 4

14. *Diascia anastrepta* Hilliard & Burt in Notes R. bot. Gdn Edinb. 41: 312 (1983). Type: Natal, 2929 CB, Underberg distr., Sani Pass, c. 2 620 m, 17/2/1982, Hilliard & Burt 15498 (E, holo; NU, iso.).

Stoloniferous perennial herb, stems many from the crown, subsimple to well-branched, up to c. 400 mm long, 2–3 mm diam., decumbent or sub-erect, lower part rooting, glabrous or nearly so on leafy parts, glandular-puberulous on the inflorescences. *Leaves* glabrous, mostly 10–25 × 8–20 mm, smaller upwards, ovate or elliptic-ovate, subacute or obtuse, base subcordate or broadly cuneate, margins subentire to serrate; petiole up to 8 mm long; uppermost leaves often subsessile. *Flowers* few to many in terminal racemes; bracts up to 6 × 4 mm, ovate-lanceolate, acute; pedicels mostly 20–35 mm long, often spreading widely particularly in fruit, glandular-pilose. *Calyx* segments lanceolate, two anticus ones 5 × 2.25 mm, three posticus ones slightly smaller, glandular-pilose. *Corolla* tube c. 6 mm long, shallowly invaginated between the spurs and with two parallel grooves down the back flanking the convex “window”, two lateral spurs c. 6–7 mm long, spreading at right angles to the tube, the tips upcurved, each with a patch of dark sessile glands within; limb c. 24 mm long, anticus lobe c. 12 × 12 mm, two lateral lobes c. 8 × 7 mm, two posticus lobes c. 6 × 6 mm, all subrotund, whole corolla rich pink with a white patch on outside on floor of tube and at base of anticus lobe, marking the hollow in which the two fully fertile stamens lie, sparsely glandular-pilose outside, glabrous inside except for two patches of dark sessile glands at the mouth of tube and base of anticus lobe flanking the essential organs and sometimes a few similar glands around the sinuses of the four upper lobes, “window” elongate, concave, reaching nearly to the base of the filaments where it merges into a short boss, yellow marked with dark blotches and surrounded by a crimson suffusion. *Stamens* with filaments of the anticus pair arching up and forward, c. 6 mm long, glandular-pubescent in upper part, anthers greatly reduced, sometimes sterile, sometimes producing a little yellow pollen; filaments of the posticus

pair reclining in a hollow in the floor of the corolla tube and base of antecous lip; anthers c. 1.5 mm long, pollen green. *Ovary* c. 2.5×1.25 mm, lanceolate in outline, ovules many in each loculus, style c. 3 mm long, reclining; stigma capitate, lying between the lower pair of anthers. *Capsule* up to 15×7 mm, lanceolate in outline; seeds c. 1.5 mm long, curved, winged and ridged. Fig. 8 a–d.

SELECTED CITATIONS

NATAL—2829 (Harrismith): Bergville distr., Cathedral Peak Forestry Reserve, Upper Masonjwaan Valley (-CC), 7000 ft., 31/12/1964, *Schelppe* 7167 (BOL, K); ibidem, Organ Pipes Pass area, 9300 ft., 29/3/1953, *Killick* 1912 (PRE); ibidem, Cleft Peak, 10 000 ft., 21/1/1956, *Edwards* 1166 (NU, PRE); ibidem, Ndedema valley near Schoongezicht cave, 16/4/1978, *Hilliard* 8138 (E, NU).

—2929 (Underberg): Estcourt distr., Giant's Castle (-AD), 8000 ft., 12/1914, *Symons* 314 (PRE); ibidem, 1 800 m, 14/12/1978, *Stewart* 2074 (K, NU); ibidem, hort. Kirstenbosch, 23/11/1977, *Winter* 852/77 (NBG); ibidem, Bushman's River Pass, 7200–9000 ft., 22/1/1940, *West* 1648 (BOL, PRE); Mpendhle distr., Highmoor Forest Reserve, ridge SE of Giant's Castle, c. 2 440 m, 4/1/1983, *Hilliard & Burt* 16156 (E, K, NU, PRE, S); Kamberg area, 'Storm Heights', c. 2 100 m, 16/12/1978, *Hilliard & Burt* 11775 (E); Upper reaches of Ntshishini river (-CB), c. 2 440 m, 2/12/1982, *Hilliard & Burt* 15772 (E, NU); Underberg distr., 5–7 miles NNW of Castle View Farm, headwaters Mlahlangubo river, 2 500–2 590 m, 23/1/1982, *Hilliard & Burt* 15326 (E, NU); Cobham Forestry Reserve, Lakes Cave area, c. 2 380 m, 12/12/1982, *Hilliard, Burt & Manning* 15941 (E, K, NU, PRE).

LESOTHO—2828 Butha Buthe distr., between Oxbow river campsite and Khatibe B (-DC), 8500 ft., 21/1/1962, *Troughton* B32 (GRA); Between Mota Pass and Thakabanna Cattle Post (-DA), 10 000 ft., 7/2/1959, *Coetsee* 378 (NBG); Top of Mota Pass, 10 000 ft., 6/2/1954, *Coetsee* 429 (NBG); Khatibe camp C above Tshlanyana valley, 8600 ft., 20/1/1962, *Lubke* 241 (PRE); Upper Moteng Pass (-DC), 2 600 m, 28/1/1952, *Killick* 4426 (PRE).

—2927 (Maseru): Leribe distr., Thaba Phutsoa (-DB), 9500 ft., 1/1946, *Archibald* 519 (GRA); Maseru distr., Blue Mountain Pass (-BD), c. 2 745 m, 13/1/1979, *Hilliard & Burt* 12102 (E, NU); ibidem, c. 3 000 m, 20/1/1981, *Schmitz* 9185 (PRE); Bushman's Pass, c. 2 100 m, 13/1/1979, *Hilliard & Burt* 12120 (E, NU); Molimo Nthuse Pass, c. 2 285 m, 10/1/1979, *Hilliard & Burt* 12030 (E, NU).

—2928 (Marakabei): Berea/Maseru distr., Mamalapi (-AC), 8000 ft., 1/1/1949, *Compton* 21413 (NBG).

—2929 (Underberg): Mokhotlong distr., Sani Top, E of chalet (-CB), c. 2 900 m, 16/1/1976, *Hilliard & Burt* 8831 (E, K, MO, NU, PRE).

TRANSKEI—3028 (Matatiele): Ramatseliso (-BB), c. 7600 ft., 27/2/1962, *Acocks* 22065 (PRE).

Diascia anastrepta ranges over the high mountains of Lesotho and has been recorded along the face of the Drakensberg in Natal and Transkei from Cathedral Peak to Ramatseliso, over an altitudinal range of 1 800–3 000 m. It commonly grows in damp and partially shaded places along the foot of basalt cliffs or in the shelter of grass tufts along rocky watercourses; occasionally it grows among rocks in the boulder beds of

streams. The plants form loose tangled masses, a growth habit which at once distinguishes it from both its close allies, *D. purpurea* and *D. megathura*. The corollas of *D. anastrepta* and *D. megathura* are strikingly similar, but they differ in a number of features: the two lateral corolla lobes in *D. anastrepta* do not ascend to join the two posticous lobes as they do in *D. megathura*, and the tips of the spurs are slightly upcurved (whence the trivial name), not straight or slightly downcurved (Fig. 8). In *D. anastrepta*, the window is shallowly concave when viewed from the front; from the back it is of course convex, with a longitudinal groove on either side. In *D. megathura*, the window is flat, and, viewed from the back, is seen to lie on the floor of the single groove running down the corolla tube. None of these characters is easy to see in dried material, and then the short hairs on the pedicels of *D. anastrepta* (scarcely 0,25 mm long, not at least 0,5 mm) and on the filaments of the reduced stamens (up to 0,5 mm long, not mostly at least 1 mm long) are useful distinguishing characters.

15. *Diascia megathura* Hilliard & Burt in Notes R. bot. Gdn Edinb. 41: 313 (1983). Type: Natal, 2929 CB, Underberg distr., Cobham Forest Reserve, Upper Polela Cave, c. 2 075 m, 12/2/1979, Hilliard & Burt 12465 (E, holo.; NU, iso.).

Stoloniferous perennial herb, stems few or several from the crown, simple or sparingly branched, up to 450 mm long, 2–3 mm diam., lower part prostrate, rooting near base, flowering part erect, sparsely glandular-pilose, more densely so on the inflorescence. *Leaves* mostly 15–30 × 11–20 mm, diminishing in size upwards, ovate, elliptic-ovate or broadly elliptic, apex obtuse, base broadly cuneate, margins entire to obscurely serrulate or crenate, thick-textured, glabrous or nearly so above, a few long gland-tipped hairs mainly over the veins below, dark green above, sometimes reddish below; petiole up to 3 mm long, upper leaves nearly sessile. *Flowers* somewhat nodding, few to many in terminal racemes, simple or sparingly branched; bracts up to 6 × 4 mm, ovate-lanceolate, acute; pedicels mostly 15–20 mm long, spreading at an angle of about 45°, curved downwards at the tip, glandular-pilose. *Calyx* segments lanceolate, two anticus ones c. 5 × 2 mm, three posticus ones slightly smaller, glandular-pilose. *Corolla* tube c. 6 mm long, invaginated between the spurs and deeply grooved down the back, two lateral spurs c. 6–8 mm long spreading at right angles to the tube, each with a patch of dark sessile glands within at the tip; limb c. 20 mm long, anticus lobe c. 9 × 11 mm, hemispherical, the two lateral lobes much smaller and ascending to join the two posticus ones, forming an upper lip c. 9 × 16 mm, lobes ± hemispherical, whole corolla rich pink, sparsely glandular-pilose outside, glabrous inside except for two patches of dark sessile glands at the

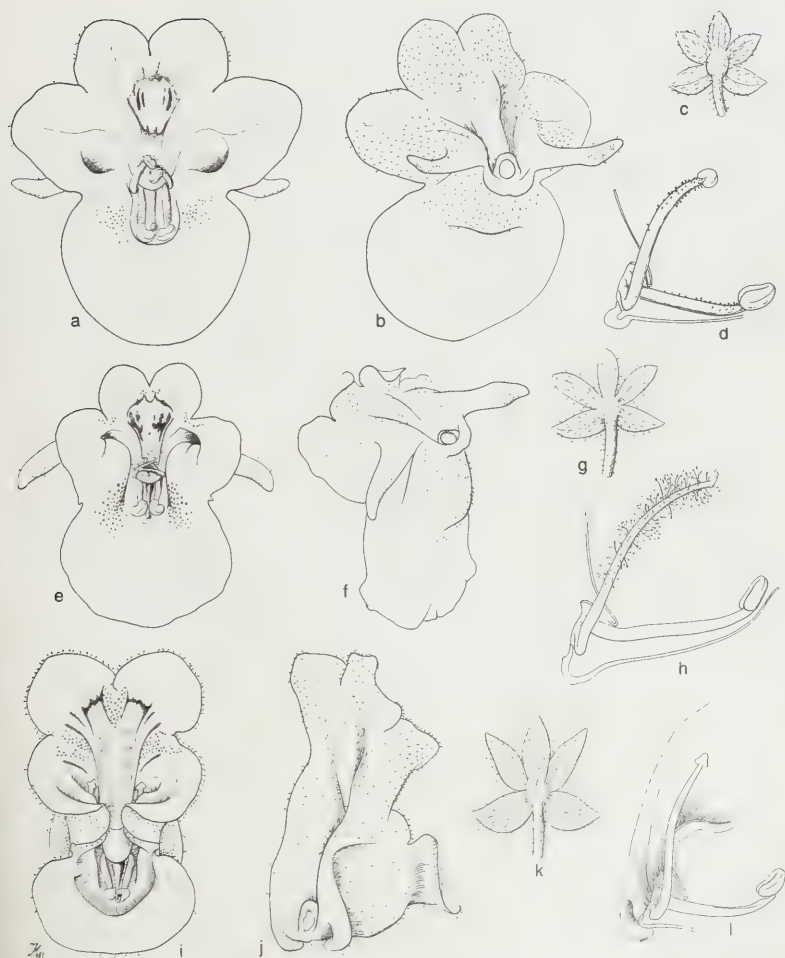


FIG. 8.

Diascia anastrepta (Hilliard & Burt 15498); a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, 2 stamens and corolla base in section ($\times 4$). *D. megathura* (Hilliard & Burt 12465); e, corolla, front view ($\times 2.5$); f, corolla, back view ($\times 2.5$); g, calyx ($\times 2.5$); h, 2 stamens and corolla base in section ($\times 6$). *D. purpurea* (Stewart & Manning 2240); i, corolla, front view ($\times 2.5$); j, corolla, back view ($\times 2.5$); k, calyx ($\times 2.5$); l, 2 stamens and corolla base in section ($\times 3.5$; Hilliard & Burt 14441).

mouth of the tube, on the ridges flanking the essential organs, and sometimes a few similar glands around the sinuses of the 4 upper lobes, "window" elongate and merging with a boss descending to the base of the filaments, yellow marked in the upper part with dark brownish-maroon blotches and streaks. *Stamens* unlike, the filaments of the anticus pair arching up and forward, c. 6 mm long, glandular-villous in the upper part, anthers greatly reduced, sterile or containing a few yellow pollen grains; filaments of the posticus pair reclining in a hollow in the floor of the corolla tube, c. 3 mm long, glabrous, or with a few gland-tipped hairs; anthers c. 1.5 mm long, pollen green. *Ovary* c. 2×1 mm, deltoid in outline, ovules many in each loculus; style c. 3 mm long, reclining; stigma capitate, lying between the lower pair of anthers. *Capsule* up to 20×7 mm, lanceolate in outline; seeds c. 1.75 mm long, curved, broadly winged, ridged. Figs. 2 g-i, 8 e-h.

CITATIONS

NATAL—2929 (Underberg): Polela (-CB), 6–7000 ft., 2/1896, *Evans* 635 (NH); 5–7 miles NNW of Castle View Farm, headwaters of Mlahlangubo river, c. 2 100 m, 18/1/1982, *Hilliard & Burt* 15142 (E, K); Garden Castle Forest Reserve, main stream valley W of forester's house, c. 1 800 m, 28/1/1975 *Hilliard & Burt* 7804 (E, K, MO, NU, PRE); ibidem, Mlambonja valley, 1 950–2 075 m, 4/1/1982, *Hilliard & Burt* 14872 (E, NU); ibidem, Sipongweni, 2 100 m, 20/2/1981, *Hilliard & Burt* 13995 (E, NU); ibidem, 1/1946, *Crookes* 69 (NU); ibidem, Lakes Cave area, c. 2 100 m, 12/12/1982, *Hilliard, Burt & Manning* 15949 (E, NU); Bushmen's Nek area, Thamathu Pass, 2 285 m, 13/2/1982, *Stewart & Manning* 2272 (E, NU); ibidem, path to Forestry lookout, 1 920 m, 12/2/1982, *Stewart & Manning* 2271 (NU); Polela distr., Bulwer (-DD), 1 770 m, 1/1950, *Harvey* 5 (NU).

LESOTHO—2929 (Underberg): Sehlabathebe National Park, waterfall of the Tsoelikana river (-CC), 2 400 m, 9/1/1976, *Beverly* 277 (PRE).

Diascia megathura is very closely allied to *D. purpurea* (no. 16), and seems to replace it in the southern Drakensberg: *D. purpurea* has been recorded as far south as the headwaters of the Loteni, while the northernmost station for *D. megathura* is on the headwaters of the Polela, some 25 km to the SW. However, the intervening country is very rugged and difficult of access and one or both of these species will certainly occur there. *Diascia megathura* may be found in short grass along stream valleys, but it also grows in stony or gritty soil on slopes and on the tops of ridges; it is possibly tolerant of drier conditions than *D. purpurea*.

In floral structure, *D. megathura* strongly resembles *D. anastrepta* (see above).

16. *Diascia purpurea* N.E. Br. in Kew Bull. 1895: 151 (1895); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 161 (1904); Trauseld, Wild Flowers Natal Drakensberg 165 cum tab. (1969). Type: Natal, [Estcourt distr.] on the Dra-

kensberg, in Tiger Cave Valley, [headwaters of Hlatikulu river] Jan. 1895, among grass, scarce, leaves deep purple on lower side, *Evans* 377 (K, holo.).

Stoloniferous perennial herb, stems few from the crown, simple or sparingly branched, up to 450 mm long, 3,5 mm diam., lower part prostrate, rooting near base, flowering part erect, sparsely glandular-pilose, more densely so on the inflorescence. *Leaves* mostly 20–45 × 15–50 mm, diminishing in size upwards, ovate, apex obtuse, base broadly cuneate, margins subentire or obscurely crenate, thick-textured, glabrous except for a few gland-tipped hairs on margins and over veins, dark green above, all but the youngest deep purple below; petiole up to 2 mm long, uppermost leaves nearly sessile. *Flowers* nodding, many in a terminal raceme, simple or sparingly branched, bracts up to 6 × 5 mm, ovate-lanceolate, acute; pedicels mostly 13–25 mm long, spreading at an angle of about 45°, curved at the tip, glandular-pilose. *Calyx* segments lanceolate, two anticus ones 5,5 × 2,25 mm, three posticus ones slightly smaller, all green, glandular-pilose. *Corolla* tube c. 5–7 mm long, bowl-shaped, deeply grooved down the back, two lateral spurs c. 3–4 mm long, strongly curved inwards under the base of the bowl, with a patch of dark sessile glands within at the tips; limb c. 18–20 mm long, anticus lobe very short (c. 2,5 mm), the two lateral lobes ascending to join the two posticus ones forming an upper lip c. 13 × 16 mm, lobes ± hemispherical, the laterals inflexed, whole corolla light to dark salmon-pink, spurs and the bowl of the corolla tube white, sparsely glandular-pilose outside, glabrous inside except for three patches of dark sessile glands around the sinuses of the four upper lobes; “window” elongate forming a grooved boss descending from just below the posticus sinus to the base of filaments, yellow marked in the upper part with brownish-maroon streaks or blotches. *Stamens* unlike, anticus pair erect, filaments c. 7 mm long, glandular-puberulous at the tips, anthers greatly reduced, sterile or producing a little yellow pollen; posticus pair projecting forward and lying in the bowl of the corolla tube, anthers 1,75 mm long, pollen green. *Ovary* c. 2,5 × 1,5 mm, deltoid in outline, ovules many in each locus; style c. 5 mm long, reclining, stigma capitate, lying between the lower pair of anthers. *Capsule* c. 24 × 10 mm, oblongate in outline; seeds c. 2,5 mm long, curved, broadly winged. Fig. 8 i–l.

SELECTED CITATIONS

ORANGE FREE STATE—2828 (Bethlehem): Qwa-Qwa, near base of The Sentinel (-DB), 8–9000 ft., 21/2/1928. *Grant* 3630 (BOL. GRA. K. PRE); *ibidem*. 15/2/1983, *Roux* 1514 (NBG, NU).

NATAL—2828 (Bethlehem): Royal Natal National Park, Mahai Valley (-DB), 5100 ft., 13/4/1946. *Schelp* 1523 (NU); *ibidem*, path to Broome Hill from Witziess-

hoek resort, 7000 ft., 3/2/1982, *Stewart & Manning* 2258 (E, NU); ibidem, Devil's Hoek Valley, c. 5500 ft., 22/3/1981, *Hilliard & Burt* 14441 (E, NU); Mont-aux-Sources, 9–10 000 ft., 23/2/1926, *Bayer & McClean* 300 (K, PRE).

—2829 (Harrismith): Cathedral Peak area, Cleft path (-CC), 7400 ft., 1/1944, *Schelte* 515 (NU); ibidem, below Organ Pipes Pass, c. 8000 ft., 22/1/1956, *Edwards* 1182 (NU, PRE).

—2929 (Underberg): Estcourt distr., Giant's Castle (-AD), 7–8000 ft., 1/1915, *Symons* 305 (PRE); Mpendhle distr., Highmoor Forest Reserve, headwaters of Elandshoek River (-DB), 7700–8000 ft., 5/1/1983, *Hilliard & Burt* 16227 (E, NU).

—2930 (Pietermaritzburg): Lion's River distr., Nottingham Road (-AC), *Harrison* 4 (PRE).

Diascia purpurea has a limited distribution in the northern part of the Natal Drakensberg and its foothills, above c. 1 675 m, from The Sentinel and Mont-aux-Sources to the headwaters of the Loteni river immediately south of Giant's Castle. It has quite the most bizarre corolla form of any species we know; also, the corollas hang face downwards and the pollination biology of this, and of all the species, would make a fascinating study. The plants may be locally common but are easily overlooked because the decumbent stems lie hidden by grasses and bushes. However, they often grow in rich, moist basaltic soils laid bare by paths and tracks.

The only species with which *D. purpurea* is likely to be confused is *D. megathura* (no. 15); they are remarkably alike in habit and foliage and, together with *D. anastrepta* (no. 14), share the character of two erect reduced stamens, two reclining fully developed ones. But in *D. purpurea* the two spurs are very short and curve in under the bowl of the corolla tube; in both *D. megathura* and *D. anastrepta* the spurs are much longer and lie at right angles to the corolla tube. These characters will always serve to distinguish dried specimens; the living plants show further differences in corolla form that tend to disappear in the dried state except perhaps for the elongated upper lip of *D. purpurea*. (See Fig. 8).

GROUP 5

17. *Diascia integerrima* Benth. in Hook., *Comp. Bot. Mag.* 2: 18 (1836) and in DC., *Prodr.* 10: 259 (1846); Hiern in Thiselton-Dyer, *Fl. Cap.* 4 (2): 159 (1904). Lectotype: Cape, [Barkly East distr.,] Witbergen, an steinigen grasreichen Bergabhängen und felsigen Oertern 6000–7000 Fuss, Januar, *Drège* (K, lecto.; E, isolecto.).

?*Nemesia hastata* Benth. in DC., *Prodr.* 10: 260 (1846); Hiern in Thiselton-Dyer, *Fl. Cap.* 4 (2): 175 (1904). Type: Cape, [Middelburg distr.,] in stony grassy places by the roadside, on the southern side of the Naauw Poort, *Burchell* 2783 (G–DC, holo.; K, iso.).

?*Diascia moltenensis* Hiern in Thiselton-Dyer, *Fl. Cap.* 4 (2): 158 (1904).

Type: Albert div., Broughton near Molteno, 6300 ft., Dec. 1982, *Flanagan 1616* (BOL, K, NU, SAM).

Stoloniferous perennial herb, stems many from the crown, tufted, branching mostly low down, mostly up to c. 450 mm tall, but reaching 1 m or more if straggling up through other vegetation, c. 2 mm diam., erect, glabrous. *Leaves* mostly $13-40 \times 1-3$ (-6) mm (ratio 6-16:1) (but see discussion), becoming smaller upwards, linear to oblong-lanceolate, apex subacute, base cuneate, margins entire or with an occasional minute tooth, glabrous; petioles 1-3 mm long. *Flowers* several to many in terminal racemes; bracts up to 5×2 mm, lanceolate, pedicels c. 6-18 mm long, ascending at an angle of c. 45° , they and the inflorescence axis glandular-puberulous, hairs scarcely 0.25 mm long. *Calyx* segments spreading, lanceolate, two anticus ones $3-4 \times 1.25-1.5$ mm, three posticus ones slightly smaller, all green, glandular-puberulous outside. *Corolla* tube c. 5-6 mm long, not invaginated, deeply channelled on the anticus side forming the keel, two lateral spurs 4-6 mm long, directed straight down, the tips strongly incurved, with a patch of dark sessile glands within; limb c. $17-24 \times 15-24$ mm, anticus lobe $7-11 \times 9-15$ mm, with a raised keel at the base (part of the tube) separating the openings to the two spurs, two lateral lobes $5-8 \times 5-9$ mm, two posticus lobes $5-7 \times 4-7$ mm, all lobes subrotund, rose-pink, keel usually covered in dark sessile glands that extend briefly onto the palate, glands sometimes few or wanting, a few sometimes present below the upper sinuses, the "window" shallowly concave, yellow and maroon. *Stamens* standing erect, the anthers almost hidden under the upper lip, filaments 2.75-3 mm long, glandular-puberulous; anthers c. 0.75 mm long, cohering strongly; pol-

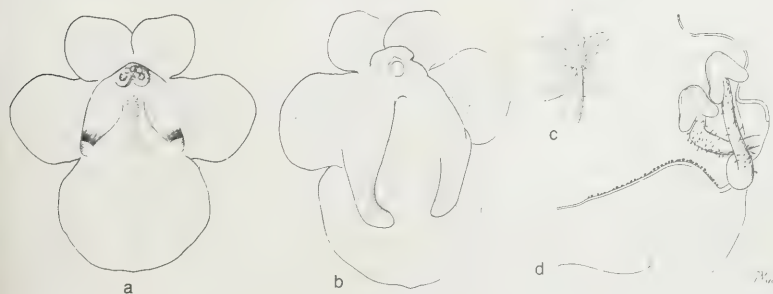


FIG. 9.

Diascia integerrima (Bigalke sub *Batten* 589); a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, 2 stamens and corolla base in section ($\times 6$).

len yellow. *Ovary* 1.5 × 1 mm, deltoid in outline, ovules many in each loculus; style 1.5 mm long, stigma capitate, lying between the anthers. *Capsules* (5-) 6-15 mm long, urceolate; seeds 1 mm long, curved, winged and ridged. Figs 2 j-l, 9 a-d.

SELECTED CITATIONS

LESOTHO—2828 (Bethlehem): Leribe distr., Leribe (-CC), *Dieterlen* 369 (K, PRE, SAM).

—2927 (Maseru): Berea distr., near Mateka (-BB), c. 6000 ft., 22/3/1951, *Bruce* 351 (K, PRE); Mamathes, 5850 ft., 3/1941, *Jacot Guillarmod* 552 (PRE); Bushman's Pass (-BD), 10/1/1979, *Hilliard & Burt* 12035 (E, NU); Makhaleng Valley near Qilolane Falls, c. 7000 ft., 11/1/1979, *Hilliard & Burt* 12045 (E, NU); Molimo Nthuse, 3/1977, *Schmitz* 7321 (PRE); Roma, Mafefoane (-BC), 23/1/1975, *Schmitz* 1507 (PRE).

—2928 (Marakabei): Maseru distr., Semonkong (-CC), c. 7000 ft., 28/11/1976, *Davidson* 3029 (PRE); 3 km from Taung on road to Matabeng (-DB), 1980 m, 1/12/1977, *Killick* 4270 (PRE).

—2929 (Underberg): Merareng on the Sinqubeta River (-AA), c. 8000 ft., 1/1953, *Liebenberg* 5668 (PRE); Mokhotlong distr., Phuta (-AC), 9500 ft., 26/2/1949, *Compton* 21585 (NBG); 1½ miles downstream from top of Langalibalele Pass, Lekhalabalete stream (-AD), c. 9400 ft., 11/2/1972, *Wright* 1266 (NU); Sehlabathebe National Park (-CC), 2400 m, 16/2/1975, *Beverly* 239 (PRE).

—3028 (Matatiele): Qacha's Nek distr., near Qacha's Nek, Rapase (-BA), 5500 ft., 10/3/1936, *Galpin* 14050 (K, BOL, PRE); Quthing distr., Buffalo river waterfall (-CA), c. 7100 m, 14/3/1904, *Galpin* 6782 (BOL, K, GRA, PRE, SAM); Orange River valley, c. 6000 ft., *Staples* 100 (PRE).

ORANGE FREE STATE—2827 (Senekal): Gumtree (-DC), 21/3/1939, *Boddam-Wetham* 911/11 (NBG); Ficksburg, Moolman's Hoek Peak (-DD), 9000 ft., 30/11/1934, *Galpin* 13926 (BOL, PRE).

—2828 (Bethlehem): Farm Koeberg 1663 (-BC), 1825 m, 24/2/1972, *Scheepers* 1825 (PRE); Near Fouriesburg, farm Wynford (-CA), 29/12/1927, *Stokoe* 1512 (PRE); Clarens (-CB), 16/4/1940, *van der Linde* 78 (PRE); Witzieshoek (-DB), 3/1917, *Junod* TM 17500 (PRE).

—2829 (Harrismith): Mount Pelaa (-BA), 6200 ft., 21/12/1973, *Ferreira* 112 (PRE).

—3026 (Aliwal North): Rouxville (-BD), 1/9/1926, *Maree* 58 (PRE).

NATAL—2929 (Underberg): Garden Castle Forest Reserve, Mlambonya valley, path to Mashai Pass (-CA), 2135 m, 8/1/1982, *Hilliard & Burt* 15032 (E, NU); Sani Pass (-CB), c. 2440 m, 22/3/1977, *Hilliard & Burt* 9766 (E, NU); Cobham Forest Reserve, Upper Polela Cave area, c. 2285 m, 13/2/1979, *Hilliard & Burt* 12475 (E, NU).

—3029 (Mount Currie): Vaalbank (-CB), 27/12/1879, *Haygarth* sub *Wood* 4225 (K).

TRANSKEI—3027 (Lady Grey): Herschel distr., 17-20 miles SE of Tele police station on Lundean's Nek road (-BC), 4/11/1955, *Marais* 1060 (PRE).

CAPE—3025 (Colesberg): Wodehouse div., Waterkloof Pass (-AD), 6500 ft., 25/2/1946, *Acocks* 12524 (PRE).

—3026 (Aliwal North): Albert div., Burghersdorp (-CD), 1/1925, *Thode* A501 (PRE); Aliwal North distr., Joubert, 1/1925, *Thode* A500 (PRE).

—3027 (Lady Grey): Lower slopes of Witteberg, road to Joubert's Pass (-CA/-CB), c. 1800 m, 17/1/1979, *Hilliard & Burt* 12128 (E, NU); Farm Ossa between Lady Grey and Barkly East via Joubert's Pass (-CD), 6500 ft., 18/1/1982, *Matthews* 844 (NBG, NU); Barkly East distr., Lundean's Nek (-DA), c. 7400 ft., 21/1/1982, *Mat-*

thews 829 (NBG); Witteberg, farm Beddgelert, c. 1890 m, 1/12/1981, *Hilliard & Burt* 14591 (E, NU); Ben Mcdhui, gorge of the Bell River (-DB), 2 440 m, 7/2/1983, *Hilliard & Burt* 16557 (E, NU); Old Lady Grey—Barkly East road above Kraai River (-DC), 5600 ft., 29/1/1981, *Hilliard & Burt* 14569 (E, NU); 2 miles N of Mo-shesh's Ford (-DD), 19/11/1969, *Edwards* 4189 (PRE); Rhodes, 6500 ft., 16/5/1897, *Galpin* 2330 (BOL, PRE).

—3028 (Matatiele): Kloppershoek valley NE of Rhodes (-CA), c. 2 000–2 200 m, 14/2/1983, *Hilliard & Burt* 16632 (E, NU); Near the top of Naude's Nek, 8000 ft., 19/1/1982, *Matthews* 801 (NBG).

—3125 (Steynsburg): Middelburg distr., Middelburg (-AC), 6/4/1945, *Archibald* 2771 (GRA); Wolwe Kop, *Burke* (K).

—3126 (Queenstown): Andriesberg (-DA), 6400–6600 ft., 3/1896, *Galpin* 2114 (BOL, PRE); Sterkstroom [probably between Molteno and Queenstown], 4000 ft., *Sim* 20057 (PRE).

—3127 (Lady Frere): Elliot distr., Fetcani Pass (-BB), c. 2 285 m, 22/1/1979, *Hilliard & Burt* 12329 (E, NU).

Diascia integerrima is relatively widely distributed from the mountainous areas of the north east and eastern Orange Free State through Lesotho to the mountains of the north east Cape from Middelburg on the northern flank of the Sneeuwberg in the west to the Witteberg and Cape Drakensberg in the east; it is also found in the southern Natal Drakensberg and, despite lack of records, certainly occurs in the intervening parts of the Drakensberg in Transkei. It grows in the crevices of rock outcrops and on cliffs, or in loose or hard-packed gritty soil on slopes and along streambanks, and is clearly more tolerant of dry conditions than most species of *Diascia*.

Bentham (1836) cited two *Drège* specimens under his name *D. integerrima*, one from the Witteberg, one from Los Tafelberg. The specimen from Los Tafelberg (between Tarkastad and Cradock) is now in poor condition, but it is possible to see that the corolla lacks a median keel, one of the characteristic features of *D. integerrima*; it is probably *D. capsularis*. The specimen from the Witteberg is in good condition and we have chosen it as the lectotype.

The narrow leaves give typical *D. integerrima* an easily recognised facies. It could be confused with *D. patens*, which has somewhat similar leaves, but *D. integerrima* has a distinctive corolla form: the median keel, which is often gland-dotted, is very prominent and separates the openings to the two lateral spurs; these spurs are directed straight down, are hooked at the tips and lie almost parallel to one another, separated by the deep channel that forms the keel.

Hiern sought to distinguish *D. moltenensis* from *D. integerrima* by its shorter leaves with sparingly toothed, rather than entire, margins. *D. integerrima* may also have toothed leaves, but those of *D. moltenensis* are mostly shorter (7–17 mm, not 13–40 mm) and are proportionally broader (1.5–5:1, not 6–16:1); however, plants that are undoubtedly *D. integerrima*,

may have shorter and broader leaves near the base (e.g. *Hilliard & Burt* 9766 and 1204).

There is another name to be considered: this is *Nemesia hastata* Benth., based on *Burchell* 2783 collected near Naauwpoort, and exactly matched by another collected by Burke at Wolvekop in the same area, which is not far to the NW of Molteno. As the name implies the leaves of this plant are distinctly hastate at the base; this is a frequent character of *D. integerrima* and of the allied *D. capsularis*.

There are two puzzling specimens collected by E. E. Galpin (nos. 2114 and 2115) on Andriesberg, near Queenstown. The differences between them are largely a matter of plant height and thus, perhaps, due to habitat exposure. Both are, on leaf form, referable to *D. moltenensis*. On 2115 Dr. A. Lewis Grant pencilled the suggestion that it represented *D. capsularis* \times *D. rigescens*. There is not the slightest indication of *D. rigescens* in the material, and the species is not known from this area. However, Andriesberg, and the whole area of the *D. moltenensis*/*Nemesia hastata* forms, is in or near the overlap area of *D. integerrima* and *D. capsularis*, and the possibility that these forms have had a hybrid origin is not to be discounted.

If *D. moltenensis* were to be retained as a species, it would have to take the earlier epithet from *Nemesia hastata*. We are reluctant to introduce this new name when the status of the taxon is so doubtful. We prefer simply to call attention to these plants and point out that there is an interesting field study in this area that will only be elucidated by patient surveys.

18. *Diascia dielsiana* Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 155 (1904). Types: Cape, Riversdale div., near Riversdale, *Rust* 125 and 227 (B⁺).

Perennial herb, stems several from a thick woody stock, up to c. 450 mm tall, woody, simple below, branching above, glabrous. *Leaves* patent or ascending, mostly c. 20–40 \times 2 mm, smaller upwards, linear-lanceolate, apex acute, base cuneate, margins entire, often strongly revolute, glabrous; petioles c. 1 mm long. *Flowers* few in lax terminal racemes, aggregated into leafy panicles; bracts up to c. 3 \times 2,5 mm, ovate, shortly acuminate, glabrous; pedicels 5–10 mm long, filiform, glandular-puberulous, ascending at an angle of c. 45°. *Calyx* segments lanceolate, very acute, glandular-puberulous; anticus pair c. 2,25 \times 1 mm, posticus ones slightly smaller. *Corolla* tube c. 2,25 mm long, not invaginated, two lateral spurs 3–4 mm long, spreading at right angles to the tube, with dark sessile glands within near the tip; limb c. 8–9 \times 7–8 mm, anticus lobe c. 4 \times 4 mm, lateral lobes 2 \times 2,5 mm, posticus lobes 1,5–1,75 \times 1,5–1,75 mm, all subrotund, sparsely glandular hairy outside, glabrous inside, “bright pink”, “window” shallowly concave. *Stamens* erect, filaments 2 mm long, very sparsely glandular-puberu-

lous, anthers 0,3 mm long, cohering. *Ovary* $1 \times 0,75$ mm, ovules many; style 1,25 mm long; stigma capitate, lying between the anthers. *Capsules* not seen.

CITATION

CAPE—3421 (Riversdale): Farm Driekuul (-AB), 5/1915, *Muir* 1993 (BOL).

Diascia dielsiana is very closely allied to *D. patens* from which it may be distinguished by its smaller flowers (corolla limb c. $8-9 \times 7-8$ mm, not c. $12-17 \times 10-17$ mm), with spurs 3-4 mm long spreading at right angles to the tube (not 4-5 mm long and diverging at an angle of c. 45°), and corolla devoid of dark sessile glands (not a transversely elongate central patch on the palate and sometimes adjacent to the upper sinuses).

It is a thoroughly ill-known species, recorded only from Riversdale district.

19. ***Diascia patens*** (Thunb.) Fourcade in Mem. bot. Surv. S.Afr. **20**: 72 (1942). Type: Cape of Good Hope, *Thunberg* (UPS).

Antirrhinum patens Thunb., Prodr. Pl. Cap. 105 (1800) et Fl. Cap. 482 (1823).

Linaria patens (Thunb.) Spreng., Syst. Veg. **2**: 793 (1825).

Nemesia patens (Thunb.) G. Don, Gen. Syst. **4**: 534 (1837-1838); Benth. in DC., Prodr. **10**: 264 (1846).

Diascia monasca Hiern in Thiselton-Dyer, Fl. Cap. **4** (2): 142 (1904). Type: Cape, Humansdorp div., on the rocky side of the mountain close to the western bank of the Wagenbooms River, on the northern side of the Lange Kloof, 11/3/1814, *Burchell* 4916 (K).

Herbaceous, probably perennial (no basal parts seen), main stems woody, at least 300 mm long, up to 3 mm diam., sprawling, clambering up to 1 m (Taylor), well-branched, glabrous. *Leaves* patent, mostly $15-36 \times 2-4,5$ mm, ratio at least 10:1, diminishing in size upwards, linear-lanceolate or lanceolate, apex acute, base cuneate, margins entire or with a few sharp teeth, glabrous, petioles 1-1.5 mm long. *Flowers* few, in lax terminal racemes; bracts up to c. 4×2 mm, ovate, very acute, or sometimes the lowermost pair leaf-like, glandular-puberulous; pedicels 13-20 mm long, ascending at an angle of c. 45° , they and the inflorescence axis glandular-puberulous. *Calyx* segments probably spreading, lanceolate, two anticus ones c. $3-4 \times 1,5$ mm, three posticus ones slightly smaller, all glandular-puberulous. *Corolla* tube c. 4-5 mm long, scarcely invaginated, two lateral spurs c. 4-5 mm long, straight, diverging at an angle of c. 45° , with a patch of dark sessile glands within near the tip; limb c. $12-17 \times 10-17$ mm, anti-

cous lobe $5-9 \times 11$, lateral lobes $3,5-5 \times 3,5-6$ mm, posticous lobes $3-4 \times 3,5-4,5$ mm, all subrotund, "claret-red" (Fourcade) "red" (Acocks) or "orange-red" (Taylor), sparsely glandular-puberulous outside, glabrous inside except for a transverse band of dark sessile glands at the base of the lower lip, sometimes a few glands below the upper sinuses as well, the "window" shallowly concave. *Stamens* possibly erect; filaments 2,5 mm long, minutely glandular-puberulous, hairs very few; anthers 0,5 mm long, cohering. *Ovary* $1,5 \times 1,25$ mm, deltoid in outline, ovules many in each loculus, style 1,5 mm long, stigma capitate. *Capsules* c. 6×3 ; seeds c. 1,5 mm long, curved, broadly winged, ribbed.

CITATIONS

CAPE—3321 (Ladismith): Rooiberg, below waterfall in Groenkloof below hut (-DA), c. 3000 ft., 22/4/1977, Taylor 9648 (PRE); Top of Rooiberg Pass S Side, 2600 ft., 6/3/1959, Acocks 20380 (NBG).

—3323 (Willowmore): Uniondale div., N of Joubertina (-DD), 2000 ft., 8/1923, Fourcade 2692 (BOL); ibidem, 7/1942, Esterhuysen s.n. (BOL); Hills of Uitenhage Carroo, Alexander Prior s.n. (K).

—3420 (Bredasdorp): Potteberg (-CA), Bayliss s.n. (K).

The original collection of *D. patens*, made by Thunberg, is unlocalised, but his second journey to Kaffraria took him through the Langekloof, whence came Burchell's collection, and he also travelled elsewhere in the present-day Uniondale district. The passage of two hundred years has done little to make the species better known, but it can be gleaned from collectors' notes that the plants favour rocky sites, and Taylor records "bed of kloof, stream-side thicket" where the plants clambered up through other bushes.

The narrow patent leaves give the species a characteristic facies, and probably dictated Thunberg's choice of epithet. The genus *Diascia* was not described until 1820, so it is understandable that Thunberg placed his plant in the long-established genus *Antirrhinum*, despite its two spurs. However, the specimen is a poor one, and the two spurs are not immediately evident; Sprengel (1825) transferred the species to *Linaria*, and G. Don (1837–38) to *Nemesia*, both genera being characterised by one-spurred corollas. Benthams (1846) accepted the species in *Nemesia* though he placed it at the end of the genus as an insufficiently known species, and in this he was followed by Hiern (1904).

Hiern failed to associate Burchell's collection from the Langekloof with Thunberg's plant, and re-described it as *Diascia monasca*, supposedly with only one broad shallow pouch, yellow within. Burchell's label describes this pouch, which is of course the window, but he does not mention the spurs. The Burchell specimen at Kew has no intact flowers left (were there ever any?) but in habit, foliage and indumentum it so exactly matches Fourcade's

collection from the same locality that we have no hesitation in equating them.

Diascia patens is allied to *D. capsularis* but can be distinguished by its much narrower and differently shaped leaves (mostly linear-lanceolate, 2–4,5 mm broad, not deltoid, 5–17 mm broad), shorter spurs (c. 5 mm long, not 9–11 mm), shorter filaments (2,5 mm, not 3–4 mm) and shorter style (1,5 mm, not 2 mm). It is sometimes confused with *D. integerrima*, which differs markedly in corolla form.

GROUP 6

20. *Diascia rigescens* Benth. in Hook., Comp. Bot. Mag. 2: 18 (1836) and in DC., Prodr. 10: 259 (1846); O. Kuntze, Rev. Gen. Pl. 3 (2): 230 (1898); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 162 (1904); Batten & Bokelmann, Wild Fl. E Cape Prov. 132, pl. 105, 2 (1966). Lectotype: E Cape, Katberg, auf Grasfeldern, 3000–4000 Fuss Höhe, November, Drège (K; E, isolecto.).

D. rigescens var. *angustifolia* Benth. in Comp. Bot. Mag. 2: 18 (1836). Type: Transkei, between the Umzimvubu and Umsikaba (sphalm Umzimkulu) rivers, 1000–2000 Fuss, October, Drège (K).

D. rigescens var. *bractescens* Hiern in Thiselton-Dyer, Fl. Cap 4 (2): 162 (1904). Type: Kaffraria, near Keiskamma river, 1860, Cooper 339 (BOL, K).

D. macowanii Hiern in Fl. Cap. 4 (2): 162 (1904). Type: E Cape, Fort Beaufort distr., Koonap, MacOwan s.n. (BOL).

Perennial herb, stems several from the crown, tufted, simple or sparingly branched, up to 1,3 m tall, 2–5 mm diam., erect or decumbent, glabrous. Leaves sometimes alternate upwards, usually crowded, mostly 15–60 × 10–37 mm, ovate, apex acute or subacute, apiculate, base cordate, margins sharply serrate, glabrous or thinly glandular-pilose, or glabrous below, glandular-puberulous on the inflorescence, thick-textured, sessile. Flowers many in crowded terminal racemes, which are often branched; bracts mostly 3–10 × 1–3 mm, ovate to linear-lanceolate, acute to acuminate; pedicels mostly 7–18 mm long, sharply ascending, glandular-pilose, hairs c. 0,3–0,6 mm long, sometimes sparse or entirely wanting. Calyx segments lanceolate two anticus ones up to 2–4 × 1,25–1,5 mm; three posticus ones slightly smaller, glandular-pilose. Corolla tube c. 4–6 mm long, not invaginated, deeply channelled on the anticus side forming the keel, two lateral spurs c. 3 mm long, directed downwards, tips strongly incurved, with a patch of dark sessile glands within; limb c. 11–18 × 11–18 mm, anticus lobe subrotund, c. 5–8 × 7,5–11 mm, two lateral lobes broadly ovate, c. 4–5 × 4–6 mm, two posticus lobes ovate or subrotund, c. 3–5 × 3,5–5 mm, all lobes pale or

rose-pink, sparsely glandular-pilose outside, glabrous inside except for stalked yellow glands on the keel, "window" shallowly concave, yellow and maroon. *Stamens* erect, filaments c. 2,5 mm long, glandular-puberulous; anthers 0,5–0,75 mm long, almost hidden under the upper lip, cohering strongly, pollen yellow. *Ovary* 0,75–1,25 × 0,75–1,25 mm, deltoid in outline, ovules many in each loculus; style 1 mm long, stigma capitate, lying between the anthers. *Capsule* c. 3–7 × 3–6 mm, ovoid; seeds c. 1,5 mm long, curved, winged and ridged. Figs 2 a–c, 10 a–d.

SELECTED CITATIONS

NATAL—3029 (Kokstad): Mount Currie distr., Kokstad (-CB), 4700 ft., 12/1883, *Tyson 1668* (PRE); Alfred distr., Weza, Zuurberg (-DA), c. 1 400 m, 29/11/1973, *Hilliard & Burt 7513* (E, K, MO, NU); Harding, farm Rooi Vaal (-DB), 4/1/1957, *Taylor 5278* (NBG).

TRANSKEI—3029 (Kokstad): Tabankulu distr., Tabankulu Mountain (-CD), c. 1 525 m, 18/11/1973, *Hilliard & Burt 7342* (E, K, MO, NU, PRE); Bizana distr., Fort Donald (-DC), 5000 ft., 12/1883, *Tyson 1668* (BOL, K, NBG, SAM).

—3127 (Lady Frere): Cala distr., Cala (-DA), 21/2/1910, *Pegler 1676* (PRE); Engcobo distr., near Engcobo (-DB), 4000 ft., 1/1896, *Bolus 8765* (PRE).

—3128 (Umtata): Tsolo distr., Chenkwe Mountain (-BA), 1896, *Flanagan 2865* (PRE); Umtata distr., Baziya Mountain (-CB), 2–3000 ft., *Baur 19* (K, SAM); ibidem, Mpolompo River valley, 1 370 m, 11/2/1981, *Hilliard & Burt 13932* (E, NU).

—3129 (Port St Johns): Flagstaff distr., near Flagstaff (-AB), 3/12/1928, *Hutchinson 1786* (BOL, K, PRE).

CAPE—3226 (Fort Beaufort): Baviaansrivierberg, Shore's Farm (-AC), 5000 ft., 19/4/1950, *Killick 846* (GRA, PRE); Bedford distr., Great Winterberg (-AD), 12, *Ecklon* (SAM); Katberg Pass (-DA), c. 1 525 m, 24/1/1979, *Hilliard & Burt 12353* (E, NU); Hogsback Forest Reserve (-DB), 9/12/1977, *Hilliard & Burt 10949* (E, K, NU, PRE); Between Keiskammahoek and Hogsback Forest Station, 22/11/1981, *Matthews 727* (NBG, NU); Old Katberg Pass, 5200 ft., 9/4/1898, *Galpin 2391* (GRA, PRE); Stockenstrom div., Willsdale, 11/1884, *Scully 111* (SAM).

—3227 (Stutterheim): Cathcart distr., Windvogelberg (-AC), 24/11/1944, *Whitworth s.n.* (BOL 2300); Guncuka forest (-CA), *van Jaarsveld 3735* (NBG); Amatola Mountains, Gaika's Kop (-CA), 29/12/1926, *Grant 3055* (BOL, GRA, PRE); Keiskammahoek distr., Rabula Forest, 15/12/1921, *Stayner 78* (GRA); Cata Forest Reserve, 3500 ft., 15/1/1948, *Story 3291* (PRE); Wolf Ridge, 4500 ft., 22/10/1965, *Wells 3231* (GRA, PRE); Thomas Mountain (-CA/-B), 1 200–1 400 m, 9/12/1981, *Hilliard & Burt 14790* (E, NU); Stutterheim distr., Evelyn valley (-CB), 13/1/1947, *Compton 19155* (NBG); Kologha Forest, 3500 ft., 27/11/1956, *Theron 2138* (PRE); Kabaku hills, 3100–3400 ft., 15/11/1942, *Acocks 9329* (PRE); Dohne Hill, 5000 ft., 1897, *Sim 20365* (NU, PRE); Mt. Kemp (-CB), c. 1 400 m, 14/12/1977, *Hilliard & Burt 11032* (E, K, NU, S); King William's Town distr., near King William's Town, summit of Pirie (-CC), 3000 ft., 11/1893, *Flanagan 2156* (BOL, PRE, SAM); Kubusie forest Reserve (-DA), 2000–3000 ft., 9/4/1972, *Thomas s.n.* (NBG).

Diascia rigescens ranges from southern Natal through the mountainous parts of Transkei to the mountains of the eastern Cape, between Cathcart, Stutterheim and King William's Town in the east and the Great Winterberg in the west. It favours moist places, particularly on the margins of forest

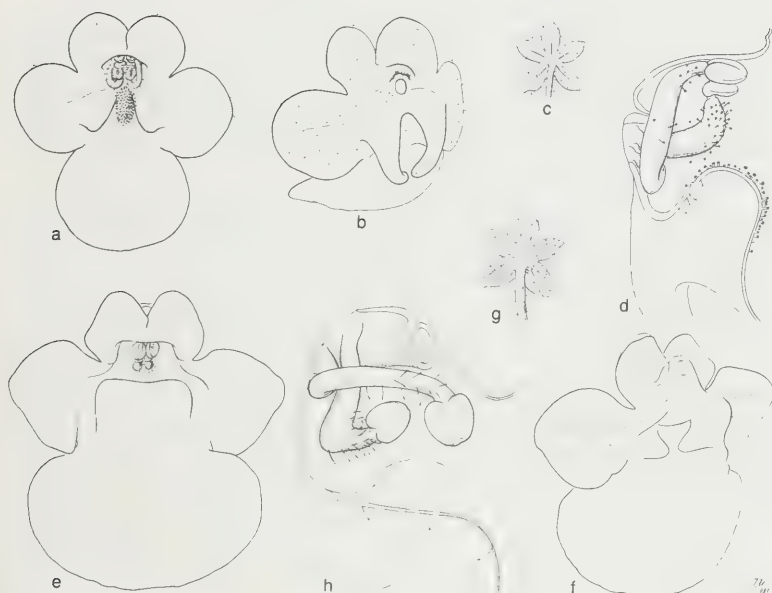


FIG. 10.

Diascia rigescens (Hilliard & Burt 12353); a, corolla, front view ($\times 2.5$); b, corolla, back view ($\times 2.5$); c, calyx ($\times 2.5$); d, 2 stamens and corolla base in section ($\times 12.5$). *D. personata* (Batten 628); e, corolla, front view ($\times 4$); f, corolla, back view ($\times 4$); g, calyx ($\times 4$); h, 2 stamens and corolla ($\times 13$).

patches. There appear to be local races of the species: specimens from Mount Kemp for instance are particularly fine and make splendid garden plants while specimens from the Zuurberg in southern Natal have less sturdy stems and smaller, paler, flowers. The Mount Kemp plant as well as those from Thomas Mountain, Hogsback, Dohne, Pirie Mountain and Keiskammahoek all have long bracts, and have been segregated as var. *bractescens*, but the distinction is not worth upholding.

Hiern described the corolla of *D. macowanii* (in synonymy above) as having "two small pouches"; this is not so; the spurs are merely infolded. MacOwan's specimen came from the Koonap river near Fort Beaufort and it is clearly the long-bracted strain of *D. rigescens*.

Diascia rigescens is very easily recognised by the short strongly raised keel covered in stalked yellow glands, and by the sessile leaves. The only

other species with sessile leaves, closely resembling these of *D. rigescens*, is *D. personata*, but the flowers are totally different.

21. ***Diascia personata*** Hilliard & Burt in Notes R. bot. Gdn Edinb. **41**: 313 (1983); Batten & Bokelmann, Wild Flow. E Cape Prov. 134 pl. 106, 4 (1966), as *D. rigescens*. Type: E Cape, East London, Beacon Bay, 9/10/1979, *Batten s.n.* (E, holo.; NU, iso.).

Stoloniferous perennial herb, stems 1 or 2 from the crown, simple below, sometimes branching above into a compound inflorescence, up to c. 1,3 m tall, 2–4 mm diam., erect, glabrous becoming glandular-puberulous on the inflorescence. *Leaves* crowded, mostly 18–53 × 6–15 mm, largest in the centre of the stem, lanceolate, apex acute, apiculate, base cordate, margins sharply serrate, glabrous, thick-textured, sessile. *Flowers* many in terminal racemes, sometimes compounded into panicles; bracts up to 2,5 × 1,25 mm, ovate, shortly acuminate; pedicels mostly 7–15 mm long, filiform, sharply ascending, glandular-puberulous mainly near the tip, the hairs scarcely 0,25 mm long. *Calyx* segments lanceolate, two anticus ones up to 2 × 1,25 mm, three posticus ones slightly smaller, glandular-puberulous. *Corolla* tube c. 2–2,5 mm long, base not invaginated, but pouched laterally above the entrance to the spurs, these c. 1,5 mm long, directed inwards towards each other, tips lacking dark sessile glands within; limb c. 7–12 × 8–15 mm, anticus lobe suborbicular, c. 3–5 × 6–10 mm, two lateral lobes ovate to suborbicular, c. 3–4 × 3,5–5 mm, two posticus lobes c. 2–4 × 2–2,5 mm, oblong to suborbicular, all pale pink, glabrous except for a few gland-tipped hairs outside, palate elevated into a transverse oblong pouch c. 2–2,5 mm deep at the margins, slightly depressed in the centre, closing the mouth of the tube, (the two inner angles of the pouch form the two spurs), “windows” two, one in the roof, one in the floor of the corolla tube, the upper (posticus) one concave, c. 0,5–1 mm deep, the lower one shallower. *Stamens* curved erect, hidden in the upper window; filaments of the anticus pair c. 2,5 mm long, glandular-pubescent above; anthers 0,75 mm long; filaments of the posticus pair c. 2 mm long, directed forward, the tips sharply curved erect, glandular-pubescent; anthers 0,5 mm long; pollen grey-green. *Ovary* c. 1,25 × 1 mm, deltoid in outline, ovules many in each loculus; style c. 1 mm long, stigma capitate, lying between the anthers. *Capsule* c. 3–7 × 3–4 mm, ovoid; seeds 1,75 mm long, curved, narrowly winged, ridged. Fig. 10 e–h.

SELECTED CITATIONS

TRANSKEI—3228 (Butterworth): Kentani distr., Qolora Mouth, near Black Rock Cave (-CB), 50 ft., 9/7/1907, *Pegler 1439* (BM, GRA, K, PRE, SAM).

CAPE—3327 (Peggie): East London distr., East London (-BB), 27/1/1979, *Hilliard & Burt 12406* (E, NU); *ibidem*, 26/12/1941, *Barker 1511* (BOL, NBG); *Bonza*

Bay and Gonubie, *Batten s.n.* (NBG); Igoda Bridge, 2000 ft., 2/8/1966, *Bayliss 3512* (NBG); Amalinda, Stony Drift Creek, c. 150 ft., 5/5/1967, *Acocks 23884* (PRE); King William's Town distr., Mount Coke (-CD), 2000 ft., 11/1892, *Sim 1425* (BOL, PRE); ibidem, 1500 ft., 7/1881, *Tyson 974* (BOL, NBG); Komgha distr., 10 miles W of Kei Mouth (-DB), 24/11/1945, *Compton 17602* (NBG); Near Komgha, 1800 ft., 2/1890, *Flanagan 518* (BOL, GRA, NBG, PRE, SAM); Komgha, 2000 ft., 8/1/1895, *Schlechter 6215* (GRA); Komgha, 1/8/1895, *Krook* in herb. *Penther 3093* (K).

Diascia personata grows in damp rough grassland near the sea or on damp grassy slopes inland, up to an altitude of c. 600 m. It appears to be confined to a small area stretching from Kentani district in Transkei across the Kei to Komgha, King William's Town and East London. It is still common around East London, but its habitat is being destroyed by urban expansion.

The flowers are small (late flowers may be even smaller than those described) but the morphology of the corolla is no less complicated than that of any of its congeners, and in some ways it is even more remarkable. In no other species known to us is the corolla personate. This pouching of the palate actually forms the two small spurs; in addition, there are two shallow depressions at the base of the lateral lobes where the two lateral spurs usually develop. The pouched palate almost masks the essential organs; the anthers, which arch up into the window cavity below the lower lip, are just visible above the depression in the centre of the palate. The two lateral depressions are also visible, but not the openings to the spurs, which lie hidden under the pouch that forms them. The yellow window above the stamens is invisible, and so is the second window in the floor of the corolla tube. When the lower lip is depressed, as it would be should an insect land on the palate, the two windows more or less merge optically to the human eye and the greenish anthers appear, centrally placed against a yellow background flanked by the usual reddish-purple or maroon markings.

The relationship of *D. personata* seems to lie with *D. rigescens*: they have similar vegetative parts and similar capsules and seeds. They diverge sharply in floral morphology, which is surely a response to different insect pollinators.

Diascia personata was first collected by Tyson in 1881, Flanagan in 1890, Sim in 1892, Schlechter and Krook in 1895, and by many another this century. It has even been illustrated (Batten & Bokelmann, loc. cit.), but nevertheless it has persistently been misidentified as *D. rigescens*, despite its totally different floral structure, which is easily detected even in dried material.

GROUP 7.

22. *Diascia macrophylla* (Thunb.) Spreng., Syst. Veg. 2: 890 (1825);

Benth. in Hook., *Comp. Bot. Mag.* 2: 17 (1836) et in DC., *Prodr.* 10: 258 (1846); Hiern in Thiselton-Dyer, *Fl. Cap.* 4 (2): 163 (1904). Type: Cape, Calvinia, near a river between Bokkeland and Hantam, *Thunberg*.

Hemimeris macrophylla Thunb., *Nov. Gen. Pl.* 4: 76 (1784), *Prodr. Pl. Cap.* 105 (1800) et *Fl. Cap.* 484 (1823).

Annual herb, main stem c. 10–600 mm long, 1–4 mm diam., occasionally simple, usually branching low down, weak, decumbent or ascending, glabrous or glandular-puberulous, glandular-puberulous on the inflorescence axes. *Leaves* in up to 7 pairs on each branch, c. 10–45 × 8–28 mm, ovate, apex acute to obtuse, base subcordate, margins subentire to sharply serrate, glabrous or with a few gland-tipped hairs on the lower margins and main veins below; petioles glandular-puberulous, up to 15 mm long, decreasing rapidly in length upwards, uppermost leaves subsessile. *Flowers* many, in long terminal racemes, simple or loosely paniced; lowermost bract leaf-like, up to c. 14 × 7 mm, upper ones becoming rapidly smaller, cordate-ovate, acuminate, glandular-puberulous; pedicels c. 15–30 mm long, filiform, glandular-puberulous, patent or deflexed, tip abruptly upcurved. *Calyx* segments lanceolate, acute, anticus pair 3 × 1,5–2 mm, three posticus ones slightly smaller, all glandular-puberulous. *Corolla* tube 4–5 mm long, invaginated then partly turned out again, two lateral spurs 10–13 mm long, straight, directed straight down, with dark sessile glands inside on one face; limb c. 14–20 × 14–17 mm, anticus lobe c. 7–11 × 7–11,5 mm, two lateral lobes 4,5–6 × 4–5 mm, two posticus lobes 4–5 × 2–3 mm, all lobes ± oblong, the posticus pair fused nearly to the apex, corolla “mauve”, “purplish-blue”, “pale blue”, “mauvy-blue”, “deep mauve”, rarely pink, glabrous outside, inside with two large patches of dark sessile glands laterally placed at the base of the anticus lobe, these glands also present at the upper lateral sinuses; “window” deltoid in outline, concave, with two lateral yellow patches themselves concave. *Stamens* projecting forward; filaments 3,25–4 mm long, glandular-puberulous, hairs sometimes sparse; anthers 0,5 mm long, cohering strongly. *Ovary* 1,5–2 × 1–1,5 mm, deltoid in outline; ovules many in each locus, style 2,5 mm long, stigma capitate, lying between the anthers. *Capsules* 8–10 × 3–4 mm, narrowly elliptic; seeds 1 mm long, curved, ridged.

SELECTED CITATIONS

CAPE—3119 (Calvinia): Between Oorlog's Kloof and Papkuilsfontein (-AC), 11/1929, *Leipoldt 3445* (BOL); Akkerendam, lower slopes of Hantam Mountains (-BD), 22/7/1961, *Barker 9316* (NBG); Near Agter Hantamsberg, Moordenaarspoort, 9/1952, *Lewis 3871* (SAM); c. 28 miles N of Calvinia, 25/9/1952, *Middlemost 1772* (BOL, NBG); 21 miles W of Calvinia, 24/9/52, *Maguire 2533* (NBG).
—3120 (Williston): Beyond Middlepost, Quaga's Pass (-CC), 29/9/1929, *Grant &*

Theiler 4899 (BOL, mixed with *D. dissimulans*); 14.7 miles along old road from Middelpost to Calvinia, 2/10/1974, *Hiemstra* 593 (NBG).

—3220 (Sutherland): A few miles north of Qaggafontein, farm Vierfontein (-AB), 4700 ft., 23/9/1981, *Snijman* 526 (NBG).

Diascia macrophylla appears to be relatively common, though probably highly localised, from the Hantamsberge to the northern part of the Roggeveld Mountains, where it has been recorded as growing under bushes on dry flats, in damp rock crevices beside a stream, and in decomposed granite, flowering in spring, between July and October. It is allied to *D. veronicoides*, *D. dissimulans* and *D. parviflora*, but is easily recognised by its exceptionally long spurs.

23. *Diascia parviflora* Benth. in Hook., Comp. Bot. Mag. 2: 17 (1836) et in DC., Prodr. 10: 258 (1846); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 154 (1904). Lectotype: Cape, Worcester div., Hex River Mountains, *Drège* (K).

D. burchellii Benth. in DC., Prodr. 10: 258 (1846); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 154 (1904). Type: Cape, Sutherland div., between Kuilen Berg and the Great Reed river, *Burchell* 1364 (K).

Annual herb, main stem 80–400 mm long, 1–3 mm diam., occasionally simple, usually branching low down, weak, decumbent or ascending, glabrous, glandular-puberulous on the inflorescence axis. *Leaves* in 3–4 pairs on each branch, c. 7–45 × 7–35 mm, ovate, apex acute or subacute, base truncate to subcordate, margins subentire to sharply serrate, glabrous or with a few gland-tipped hairs below on the main veins; petioles up to c. 30 mm long, decreasing rapidly in length upwards, uppermost leaves sessile, sparsely glandular-pubescent. *Flowers* many, in terminal racemes, simple or loosely paniced; lowermost bract leaf-like, c. 4 × 2.5 mm, the upper ones smaller, lanceolate, shortly acuminate, lower surface glandular-puberulous; pedicels mostly 5–10 mm long, filiform, glandular-puberulous, usually ascending at an angle of c. 45°, sometimes wide-spreading and then tips abruptly upcurved. *Calyx* segments lanceolate, acute, anticus pair 2.5–2.75 × 1–1.25 mm, three posticus ones slightly smaller, sparsely glandular-puberulous outside. *Corolla* tube 1.5–2 mm long, invaginated then partly turned out again; two lateral spurs c. 0.5–1 × 1 mm, slightly curved inwards, with dark sessile glands inside on the outer face; limb c. 6–12 × 6–9 mm, anticus lobe c. 3–7 × 3–6 mm, subrotund, two lateral lobes c. 2–3 × 2.5–4 mm, ovate, two posticus lobes c. 1.5–2 × 1–2 mm, oblong, fused nearly to the apex, corolla “violet” or “reddish-purple”, glabrous outside, inside with two patches of dark sessile glands below the upper lateral sinuses and two small patches laterally placed on the outer face of the palate, which is probably slightly raised; “window” shallowly concave with two lateral el-

liptic yellow patches. *Stamens* projecting forward; filaments 2–3 mm long, posticous filaments longer than anticous, sharply curved at tip to bring the anthers into the same plane as the anticous anthers, glabrous or minutely glandular-puberulous, anthers 0,25–0,5 mm long, cohering strongly. *Ovary* 1,5–2 × 1–1,25 mm, deltoid in outline, ovules many in each loculus; style 1–1,5 mm long, stigma capitate, lying between the anthers. *Capsules* 5–8 × 2–3 mm, oblanceolate in outline; seeds 0,5 mm long, curved, ridged.

SELECTED CITATIONS

- CAPE—3119 (Calvinia): Between Oorlog's Kloof and Papkuilsfontein (-AC), 9/1929, *Leipoldt* 3451 (BOL).
 —3120 (Williston): Near Middlepost, Elandsfontein farm (-CC), 28/9/1929, *Grant & Theiler* 4897 (BOL).
 —3218 (Clanwilliam): Between Grey's Pass and Graafwater (-DB), 8/1940, *Leipoldt* 3450 (BOL).
 —3219 (Wuppertal): Clanwilliam div., Cedarberg, Matjiesrivier (-AC), 9/1928, *Wagener* 177 (NBG); S Cedarberg, Krom River (-CB), 2/10/1952, *Esterhuysen* 20550 (BOL).
 —3319 (Worcester): Baviaansberg (-BA), 4000 ft., 4/11/1962, *Esterhuysen* 29785 (BOL); Ceres div., Therons Berg (-BC), 21/9/1941, *Walgate* 293 (NBG); Leeuwfontein, 26/9/1944, *Barker* 3009 (NBG); Between Osplaats and Tunnel Sidings (-BC), 8/1915, *Rogers* 16730 (BOL); Worcester div., Karoo Garden (-CB), 24/9/1949, *Barker* 5935 (BOL, NBG); Hex River (-DA), 1700 ft., 10/1893, *Bolus* 7890 (BOL).
 —3320 (Montagu): Laingsburg div., Ngaap Kop (-BA), 3500 ft., 2/9/40, *Compton* 9279 (NBG); Whitehill ridge, 9/9/1935, *Compton* 5625 (NBG); Between Matjiesfontein and Sutherland, 9/10/1928, *Hutchinson* 677 (BOL, K); Montagu (-CC), 8/1918, *Page* BOL 15627 (BOL); Cogman's Kloof, 10/8/1954, *Middlemost* 1869 (NBG).
 —3321 (Ladismith): Uniondale div., Seven Weeks Poort (-AD), 9/1912, *Phillips* 1500 (SAM); N of Rooiberg, Little Karoo (-CB), 4/8/1954, *Wurts* 1230 (NBG); Hoeks road, 2000 ft., 2/9/1953, *Wurts* 1128 (NBG).
 —3322 (Oudtshoorn): De Rust, farm Doornkraal (-BC), 400 m, 22/7/1973, *Dahlstrand* 2437 (PRE); Oudtshoorn (-CA), 8/1912, *Rogers* 4639 (BOL); Cango Caves, 16/10/1928, *Gillett* 1690 (BOL).
 —3324 (Steytlerville): Willowmore distr., above Kouga (-CB), 1000 ft., 13/9/1973, *Bayliss* 6030 (NBG).
 —3419 (Caledon): Rivier Zonder Einde and Hassaquaskloof (-BB), *Zeyher* 3478 (K, SAM).

Diascia parviflora is widely distributed in the western and south western Cape and the Little Karoo, from Calvinia south to Worcester and Caledon and east to Seven Weeks Poort in Uniondale division. It grows in damp and partially shaded places, sometimes in the shelter of cliffs or rocks, and flowers in spring, between July and October. Like so many annuals, it is very variable in stature and leaf size, and may flower in the seedling stage; there is considerable variation too in the size of the corolla limb. The names *D. parviflora* and *D. burchellii* were applied to specimens at the two extremes of the range.

The filaments of the posticous pair of stamens are abruptly curved and

somewhat thickened near the tips (this brings the anthers into the horizontal position). In one specimen on a sheet collected by E. P. Phillips in Seven Weeks Poort, this thickening is drawn out into a little spur 0.5 mm long, and thus approaches the branched filaments of *D. dissimulans* (see under that species).

24. *Diascia dissimulans* Hilliard & Burt, species nova; *D. parviflorae* Benth. affinis sed characteribus sequentibus diagnoscenda: calyx glanduloso-pubescent pilis c. 0.25–0.4 mm longis (nec glanduloso-puberulus pilis 0.01 mm longis), filamenta postica distincte ramosa (nec flexa tantum, ad apices incrassata), capsulae lineares, 12–18 mm longa (nec 5–8 mm). A *D. veronicoidei* calcaribus 2–3 mm longis introrsum curvatis (nec 4 mm longis deorsum et extrorsum curvatis), filamentis ramosis (nec simplicibus), seminibus curvatis costatis alatis (nec rectis muricatis) distinguitur.

Herba annua; caulis ad 450 mm altus, 1–2.25 mm diam., simplex vel prope basin ramosus, debilis, glaber vel glanduloso-pubescent vel pilis ad axes inflorescentiae restrictis. *Folia* in quoque ramo 3–4—jugata, c. 8–25 × 6–22 mm, ovata, apice acuto vel subacuto, basi subcordata, marginibus subintegris vel acute serratis, pilis paucis glandulosis in marginibus basin versus et inferne in costis exceptis glabra. *Flores* numerosi in racemos terminales simplices vel laxe paniculati dispositi; bractea infima foliacea, c. 9 × 7 mm, superiores minores, cordato-ovatae, acutae vel acutissimae, subtus glanduloso-pubescentes; pedicelli c. 10–15 mm longi, filiformes, glanduloso-pubescentes, patentes vel deflexi, apicibus abrupte sursum curvatis. *Calyx* 5-partitus; segmenta lanceolata, acuta, duo antica 2.75–3 × 1–1.25 mm, tria postica paulo minora, omnia glanduloso-pubescentia, pilis interdum ad dimidium inferius restrictis. *Corolla* tubo 3–4 mm longo invaginato; calcar 2–3 mm longa, leviter introrsum curvata intus facie exteriore glandulis fuscis sessilibus praedita; limbus c. 10–14 × 9–12 mm, violaceo-caeruleus, extra glaber, intus glandulis nigris lateraliter ad basin lobo antico et ad sinus superiores laterales praeditus, lobo antico 5–8 × 5–8 mm, lateralibus 3–4 × 3.75 × 5 mm, posticis 3–3.35 × 2 mm fere ad apices conjunctis, omnibus oblongis; fenestra leviter concava notis duobus lateralibus luteis rubro-purpureo-circumcinctis. *Stamina* 4, porrecta; filamenta antica 2 mm longa, postica 3.25 mm medio ramosa antheras fertiles in ramo superiore gerentia, omnia glanduloso-puberula, pilis interdum parcis; antherae 0.3 mm longae, inter se valde cohaerentes. *Ovarium* 1.5–2 × 1 mm, stylus 1–1.25 mm; ovula in loculo multa; stigma capitatum, inter antheras positum. *Capsula* 12–18 × 2.25–3 mm, linearia; semina 1 mm longa, curvata, anguste alta et costata.

Type: Calvinia distr., S of Calvinia, flats near Augustfontein Mt., 21/7.1961, Barker 9302 (NBG).

Annual herb, main stem up to 450 mm tall, 1–2,25 mm diam., simple or branching near the base, weak, glabrous or glandular-pubescent, or hairs confined to the inflorescence axes. *Leaves* in 3–4 pairs on each branch, c. $8\text{--}25 \times 6\text{--}22$ mm, ovate, apex acute or subacute, base subcordate, margins subentire to sharply serrate, glabrous except for a few glandular hairs on the lower margins and main veins below; petioles up to 20 mm long, decreasing rapidly in length upwards, uppermost leaves sessile, glandular-pubescent. *Flowers* many, in terminal racemes, simple or loosely paniced; lowermost bract leaf-like, c. 9×7 mm, the upper ones smaller, cordate-ovate, very acute to acuminate, lower surface glandular-pubescent; pedicels c. 10–15 mm long, filiform, glandular-pubescent, patent or deflexed, the tips abruptly upcurved. *Calyx* segments lanceolate, acute, anticus pair $2,75\text{--}3 \times 1\text{--}1,25$ mm, three posticus ones slightly smaller, glandular-pubescent, hairs sometimes \pm confined to lower half. *Corolla* tube 3–4 mm long, invaginated then partly turned out again; two lateral spurs 2–3 mm long, slightly curved inwards, with dark sessile glands inside on the outer face; limb c. $10\text{--}14 \times 9\text{--}12$ mm, anticus lobe $5\text{--}8 \times 5\text{--}8$ mm, two lateral lobes $3\text{--}4 \times 3,75\text{--}5$ mm, two posticus lobes $3\text{--}3,5 \times 2$ mm, fused nearly to the apex, all \pm oblong, violet-blue, glabrous outside, inside with two patches of dark sessile glands laterally placed at the base of the anticus lobe, and similar glands around the two upper lateral sinuses; “window” shallowly concave with two lateral elliptic yellow patches flanked with red-purple. *Stamens* projecting forward, filaments of anticus pair 2 mm long, those of posticus pair c. 3,25 mm long, branched about halfway and bearing the fully fertile anthers horizontally on the upper branch, all filaments glandular-puberulous, hairs sometimes sparse, anthers c. 0,3 mm long, cohering strongly. *Ovary* $1,5\text{--}2 \times 1$ mm, style 1–1,25 mm, ovules many in each loculus; stigma capitate, lying between the anthers. *Capsules* $12\text{--}18 \times 2,25\text{--}3$ mm, linear; seeds 1 mm long, curved, narrowly winged and ridged.

CITATIONS

CAPE—3119 (Calvinia): 21 miles W of Calvinia, Zoetwater (-AD), 24/9/1952, Maguire 1912 (NBG); Near Agter Hantamsberg, Moordenaarspoort (-BD), 27/9/1952, Lewis 3872 (SAM); Lokenberg (-CA), 29/8/1941, Esterhuysen 5746 (BOL).

—3120 (Williston): Beyond Middlepost, summit of Quaga's Pass, 29/9/1929, Grant & Theiler 4899 (BOL, mixed with *D. macrophylla*).

Diascia dissimulans is known only from Calvinia division of the western Cape; the collectors gave no ecological notes. All five sheets cited above were misdetermined as *D. veronicoides*. *Diascia dissimulans* resembles *D. veronicoides* because both species have patent or deflexed pedicels abruptly upcurved at the tips to bear the linear capsules erect. The seeds are remark-

ably different: those of *D. dissimulans* are curved and narrowly winged and ridged, as in nearly all species of *Diascia*, while those of *D. veronicoides* are oblong, straight, flat or folded longitudinally, and muricate. The two species differ further in the size, shape and stance of the spurs: 2–3 mm long in *D. dissimulans* and curved inwards; c. 4 mm long in *D. veronicoides* and curved out and down; *D. veronicoides* also has simple filaments, not branched. It is *D. parviflora* that *D. dissimulans* strongly resembles in floral form, and this is probably where its immediate relationship lies. The flowers of *D. dissimulans* are possibly always slightly larger than those of *D. parviflora*, but the only real difference (apart from some difference in indumentum on the calyx) lies in the filaments: the posticous filaments of *D. dissimulans* are distinctly branched, whereas those of *D. parviflora* are merely curved and thickened near the tips. We have seen a specimen of *D. parviflora* in which this thickening is drawn out into a short spur, suggesting the manner in which the branched filaments of *D. dissimulans* have evolved. The function of both the curving and the branching is to bring the anthers into the horizontal position. The capsules of *D. dissimulans* are linear, while those of *D. parviflora* are oblanceolate in outline, and much shorter, 5–8 mm, not 12–18 mm, and relatively broader. There is a slight difference too in seed morphology: both have curved, ridged seeds, but those of *D. dissimulans* are narrowly winged as well.

Diascia dissimulans appears to be a local endemic that has evolved from *D. parviflora* at the northern limit of that relatively widespread species.

25. *Diascia veronicoides* Schltr. in Engl., Bot. Jahrb. 27: 178 (1900); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 164 (1904). Type: Cape, Vanrhynsdorp div., Karreebergen, alt. 2000 ft., 18/7/1896, Schlechter 8203 (BOL, E, K, PRE).

Annual herb, main stem 10–750 mm long, 1–4 mm diam., occasionally simple, usually branching low down, weak, decumbent or ascending, glabrous, glandular-puberulous on the inflorescence axes. Leaves in 3–4 pairs on each branch, c. 10–50 × 10–45 mm, ovate, apex acute or subacute, base truncate to subcordate, margins subentire to sharply serrate, glabrous or with a few gland-tipped hairs on the lower margins and veins below; petioles sparsely glandular-pubescent, up to 20 mm long, decreasing rapidly in length, uppermost leaves subsessile. Flowers many, in long terminal racemes, simple or loosely paniced; lowermost bract leaf-like, upper ones becoming rapidly smaller, cordate-ovate, acuminate, sharply toothed, lower surface glandular-puberulous; pedicels c. 8–15 mm long, filiform, glabrous to sparsely glandular-puberulous, patent or deflexed, tip abruptly upcurved in fruit. Calyx lobes lanceolate, acute to shortly acuminate, anticus pair

2–3,5 × 0,5–1,25 mm, three posticous ones slightly smaller, glabrous or with a few glandular hairs at the base. *Corolla* tube c. 3 mm long, invaginated then partly turned out again; two lateral spurs c. 4 mm long, slightly curved, directed out then down, with dark sessile glands inside on one face; limb c. 10–13 × 9–11 mm, anticus lobe c. 4–5,5 × 5–8 mm, subrotund, lateral lobes c. 3–3,5 × 3–4,5 mm, subrotund, two posticous lobes 2–3 × 1,5–2 mm, fused nearly to the apex, corolla violet-blue, glabrous outside, inside with two patches of dark sessile glands laterally placed at the base of the anticus lobe, these glands also present below the upper sinuses; “window” concave, with two laterally placed elliptic yellow patches. *Stamens* projecting forward; filaments 2 mm long, glandular-puberulous, anthers 0,5 mm long, cohering strongly. *Ovary* 2 × 1 mm, deltoid in outline, ovules many in each loculus; style 1 mm long, stigma capitate, lying between the anthers. *Capsules* 9–16 × 1–2 mm, linear; seeds 1–1,25 × 0,3 mm, oblong, straight, flat or longitudinally folded, muricate. Fig. 2 m-o.

CITATIONS

CAPE—3017 (Hondeklipbaai): Namaqualand, Bowesdorp (-BB), 9/1941, *Stokoe* SAM 57696 (SAM).

—3118 (Vanrhynsdorp): Between Vanrhynsdorp and Klaver, Wiedouw River (-DA), 7/1948, *Lewis* 3033 (SAM).

—3119 (Calvinia): Van Rhynsdorp div., Van Rhyn's Pass (-AC), 25/7/1941, *Esterhuysen* 5281 (BOL); ibidem, *Bond* 1159 (NBG); ibidem, 28/8/1941, *Compton* 11552 (NBG); Between Oorlog's Kloof and Papkuilsfontein, 9/1939, *Leipoldt* 3444 (BOL); Nieuwoudtville, Van Wyk's farm, 9/1930, *Lavis* s.n. (20671 in herb. BOL, K); North of Nieuwoudtville, near Grasberg, 8/8/1961, *Barker* 9346 (NBG); 5 miles E of Nieuwoudtville, 24/8/1950, *Barker* 6536 (NBG); Hantam Mountains (-BC), 28/9/1929, *Grant & Theiler* 4890 (BOL); Akkerendam, lower slopes of Hantam Mountains (-BD), 22/7/1961, *Lewis* 5809 (NBG); SW of Nieuwoudtville on escarpment, Uitkomst Farm, 27/9/1970, *Barker* 10372 (NBG).

—3218 (Clanwilliam): Between Pakhuis and Doorn River (-BB), 15/8/1897, *Schlechter* 10867 (BOL).

—3219 (Wuppertal): Bidouw (-AB), 7/9/1953, *Compton* 24233 (NBG); Koudeberg near Wuppertal (-AC), 4/10/1897, *Bolus* 9065 (BOL, K, NBG); Road to Wuppertal from Clanwilliam, 9/1933, *Leipoldt* 2087 (BOL).

—3318 (Cape Town): Piquetberg distr., 8 miles N of Porterville, Nurust Farm (-BB), 22/9/1966, *Loubser* 1087 (NBG).

—3220 (Sutherland): Houthoek (-CA), 14/8/1968, *Hanekom* 1084 (K).

Diascia veronicoides is confined to the western Cape, from about Bowesdorp, north of the Kamiesberg, south to Porterville, north east of the Great Winterhoek Mountains. The collectors have given no ecological notes, but the plants probably grow in moist sandy places, and flower in spring, between July and October.

Diascia veronicoides shares with *D. dissimulans* and *D. macrophylla* the character of patent or deflexed pedicels sharply upturned at the tips to carry

the capsules erect. The capsules of *D. veronicoides* are narrowly linear, and are not easily confused with those of any species other than *D. dissimulans*. However, the capsules of *D. dissimulans* are always broader than those of *D. veronicoides* (2.25–3 mm, not 1–2 mm) and contain the curved ribbed seeds that are characteristic of most species of *Diascia*; the seeds of *D. veronicoides* are quite different: oblong, straight, muricate. For further distinguishing characters, see under *D. dissimulans*.

26. *Diascia alonsooides* Benth. in Hook., Comp. Bot. Mag. 2: 17 (1836) et in DC., Prodr. 10: 259 (1846); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 157 (1904). Type: Cape, Sneeuwbergen, an felsigen Oertern, 4000–5000 Fuss Höhe, September, *Drège* (K, holo.; E, SAM, iso.).

D. tysonii Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 143 (1904). Type: Cape, Murraysburg div., on a stony declivity near Murraysburg, 4100 ft., 8/1879, *Tyson 430* (BM, BOL, K).

Annual herb, main stem c. 150–400 mm long, up to c. 2 mm diam., branching from the base, erect or decumbent, glabrous, becoming glandular-puberulous on the inflorescence axis. *Leaves* in 3–4 pairs on each branch, c. 15–30 × 7–21 mm, ovate, apex subacute, base ± truncate to subcordate-cuneate, margins subentire to sharply serrate, glabrous, or with a few gland-tipped hairs below on the margins and veins near the base; petioles sparsely glandular-puberulous, up to 15 mm long, length rapidly decreasing upwards, uppermost leaves subsessile. *Flowers* many in terminal racemes, loosely paniced; lowermost bract leaf-like, c. 4 × 9 mm, the upper ones becoming smaller, ovate-lanceolate, shortly acuminate, base cordate-clasping, lower surfaces glandular-puberulous; pedicels up to c. 20 mm long, filiform, glandular-puberulous, often somewhat spreading, then tips upcurved in fruit. *Calyx* segments lanceolate, acute, anticus pair c. 2.5 × 0.75–1 mm, three posticus ones slightly smaller, a few small gland-tipped hairs near the base. *Corolla* subrotate, slightly bilabiate, without pouches or spurs, c. 12 mm diam., anticus lobe c. 4.5 × 5 mm, two lateral lobes c. 4 × 5 mm, two posticus lobes c. 5 × 4 mm, joined for half their length, all subrotund, probably rose-pink, glabrous and without dark sessile glands; “windows” two, one at the base of each posticus lobe, ± ovate in outline. *Stamens* projecting forward, filaments of the anticus pair 2 mm long, of posticus pair c. 4 mm, sharply bent c. 1 mm from the apex and strongly thickened there, all villous; anticus anthers c. 0.75 mm long, posticus ones a trifle smaller, all four cohering strongly. *Ovary* 1 × 0.75 mm, ovules many in each loculus, style 2 mm, stigma capitate, lying between the anthers. *Capsule* c. 7 × 2 mm, oblong-elliptic in outline; seeds c. 1 mm long, curved, ridged.

CITATION

CAPE—3220 (Sutherland): Great Reed River (-BB), 20/8/1811, *Burchell* 1373 (K).

Bentham (op. cit.) described the corolla of *D. alonsooides* as “*brevissime bifossulatis*” and Hiern described that of *D. tysonii* as having “two very small pouches at the base”, but we have not been able to detect either depressions or pouches in the material available to us. Even the two yellow windows are plane, whereas in all other species in this Section the window is at least shallowly concave.

It is extraordinary that Hiern should have described the specimen Tyson collected at Murraysburg as a new species when he cites the same collection (Tyson 430) under *D. alonsooides*. Murraysburg, site of Tyson’s collection, lies only a few kilometres from the western end of the Sneeuwberg, where Drège collected. We have seen only the types of the two names and Burchell’s collection from the Great Reed River (Groot Riet rivier) but Hiern also cites a collection made by Scully in Little Namaqualand. This is a likely distributional range, west (and probably east too) across the mountains.

Diascia alonsooides is allied to *D. parviflora* and *D. dissimulans*, which are at once distinguished by their more markedly bilabiate and shortly spurred corollas patterned with patches of dark glands.

IMPERFECTLY KNOWN TAXON

Diascia rigescens var. *montana* Diels in Engl., Bot. Jahrb. 23: 471 (1897). Type “Sulu-Natal”, Ibotwana, 2 000–2 200 m, Jan. 1891, *Thode* 69 (B†). We have failed to trace either an isotype or the locality from which the plant came.

EXCLUDED SPECIES

Diascia integrifolia [Spreng. ex] Ecklon in S. Afr. Quarterly Jnl. 4: 369 (1830), nomen.

Hiern [in Fl. Cap. 4 (2): 164, 1904] mentions this name at the end of *Diascia*, and says that the plant, found by Ecklon in Uitenhage district, is unknown to him. There are two sheets in Stockholm (S), one labelled Cape, *Zeyher*, *Diascia integrifolia*, the other from Uitenhage district, 1828, *Ecklon*, and written up as *D. integrifolia* Spr., n. sp. (not in Sprengel’s hand). The plant proves to be *Tylophora lycioides* Decne., in the Asclepiadaceae.

Diascia denticulata Benth. in Hook., Comp. Bot. Mag. 2: 18 (1836) and in DC., Prodr. 10: 259 (1846); Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 163 (1904) = *Nemesia denticulata* (Benth.) Fourcade in Mem. bot. Surv. S. Afr. 20: 73 (1941).

Diascia rotundifolia Hiern in Thiselton-Dyer, Fl. Cap. 4 (2): 152 (1904)
= *Diclis rotundifolia* (Hiern) Hilliard & Burt in Notes R. bot. Gdn Edinb.
37: 313 (1979).

APPENDIX

ALONSOA IN SOUTH AFRICA

The genus *Schistanthe* was established by Kunze in 1842, being based on a plant grown in the Botanic Garden at Leipzig; the seed had come from South Africa and had been given to Kunze by Lehmann of Hamburg. Kunze differentiated his genus from *Alonsoa* by the resupinate corolla being completely split between the morphologically upper lobes (not just divided nearly to the base), by the positionally upper lobes being saccate at the base, and by the capsule being ovate, obtuse, emarginate. The description is good and detailed: the resupinate corolla and seeds exactly fit *Alonsoa*, and we now know that the corolla in *Alonsoa* may also be split to the base. Considering the range of variation of pouches or spurs and of fruit shape in *Diascia*, Bentham (1876) was justified in accepting a similar range in *Alonsoa* and in reducing *Schistanthe* to synonymy. In this he was followed by Wettstein (1894) and Hiern (1904) and by all other authors. But Bentham also initiated the doubt that has been thrown on *Alonsoa* as a South African native. Wettstein (1894) and Hiern (1904) were apparently alone in their acceptance of it. Phillips (1926) said "it has been recorded from Uitenhage", but dropped it later (1951) and it is absent from the latest account of South African genera (Dyer, 1975). Baillon (1888), Lemée (1929) and Airy-Shaw (1966) all list *Schistanthe* as a synonym of *Alonsoa* and say that the genus is S. American.

Hiern (1904) quite correctly cited Zeyher 3485 from "woody gorges about Uitenhage" as belonging to *Alonsoa peduncularis* (Kunze) Wettstein. It agrees well with Kunze's description and matches a sheet in the Kew herbarium that had been cultivated at St. Petersburg as *Schistanthe*. Zeyher's specimen is in fruit, and it seems quite probable that it was the source of the seed that Kunze received from Lehmann. It is difficult to believe that a South American species of nothing but ornamental value had been cultivated at Uitenhage in the 1830's and had established itself as an alien. That is highly improbable; proof that it was not so lies in the fact that this South African plant is not the same as any South American species of *Alonsoa*. It is clearly a close ally, but neither the most similar species, *A. incisifolia* Ruiz & Pavon, nor any others have yellow pouches on the corolla; these are carefully described by Kunze from his living material: they must have been there. Further, the leaves and habit of the South African plant, though similar to, are not the same as those of any South American species. Whether

Alonsoa peduncularis has survived to the present day can only be settled by careful search: it seems not to have been collected since Zeyher's time. There are, however, no good grounds for doubting that there was such a plant or that it was native around Uitenhage. A translation of Kunze's original description is appended in the hope of encouraging botanists to search for this most interesting plant.

Alonsoa peduncularis (Kunze) Wettstein in Engler & Prantl, *Natürl. Pflanzenfam.* 4 (3B): 53 (1894) [sphalm. *petiolaris*]; Hiern in Thiselton-Dyer, *Fl. Cap.* 4 (2): 138 (1904)

Schistanthe peduncularis Kunze [in *Index sem. hort. univ. Lips.* 1841—n.v.] in *Linnaea* 16, *Litt. Ber.* 109 (1842); Benth. in *DC., Prodr.* 10: 251 (1846).

"*Schistanthe peduncularis* Kze. A new genus closest to *Alonsoa*, an American genus, agreeing, amongst other things, particularly in the unequally 5-partite calyx and resupinate corolla, not just split below to the base, but altogether disjunct (which, amongst the characters attributed to *Alonsoa*, I have sought in vain); but differs in the corolla being bisaccate at the base of the anticous or upper lobe and the capsule ovate, obtuse and emarginate. A genus of the tribe Verbasceae, in which it must be included, it approaches the Hemimerideae, especially *Diascia*.

"Perennial herb with the habit almost of *Alonsoa urticifolia*, a foot high, with branched tetragonous stem; leaves petiolate ovate acute subcordate at the base unequally and subduplicate-incised-serrate glabrous; peduncles solitary patent-divaricate almost an inch long. Corolla 6 lines [12 mm] in diameter, pale scarlet with yellow pits, the tube subannular yellow-green. Capsule 3–5 lines [6–10 mm] long, subcompressed, inflated at the base, from the quantity and increasing size of the seeds finally bullate and rugose, septicidally two-valved at the top, valves entire. Seeds ellipsoid, rugose, with 6 longitudinal grooves, black."

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A NEW *EUPHORBIA* FROM SOUTH AFRICA

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ABSTRACT

A new rhizomatose dwarf *Euphorbia* from the Richtersveld is described. Closely related to the recently described *E. namuskluftensis* Leach, it is distinguished by its different styles, capsule and seed, as well as by other less important characters.

UITTREKSEL

'N NUWE *EUPHORBIA* VANAF SUID-AFRIKA

'n Nuwe wortelstokagtige dwerg-*Euphorbia* vanaf die Richtersveld word beskryf. Dit is naverwant aan die pas beskryfde *E. namuskluftensis* Leach en word onderskei deur verskille aan die styl, saaddoos en saad sowel as ander minder belangrike kenmerke.

Key words: *Euphorbia*, sp. nov., Euphorbiaceae, Richtersveld, Gariep Centre.

Euphorbia miscella Leach, sp. nov.

Euphorbia wilmaniae Marl. in S. Afr. Gdng Country Life **21**: 127, 133 (1931), p.p. quoad specim. *Marloth 12441* (PRE), et distrib. Richtersveld, et excl. fig. 38.—White, Dyer & Sloane, Succ. Euphorbiaceae, **2**: 513 (1941), p.p. quoad distrib. Namaqualand.—Wilman, Check List, Fl. Pl. Ferns, Griqual. W. (1946), p.p.—Jacobsen, Lexicon Succ. Pl.: 234 (1974), p.p. quoad distrib. Namaqualand.

E. namuskluftensi Leach arcte affinis sed foliis ovalibus grandioribus; cyathio proportionem longiore angustiore, in stipite crasso, 2–4 mm longo portato; pedunculi bracteis terminalibus gemmis axillaribus saepe instructis; stylis longioribus in columnam 1,5 mm longam connatis; capsula grandiora formaque dissimili; semine grandiore glebulosiore differt; etiam ad *E. wilmaniae* Marl. characteribus vegetativis arcte accedens sed cyathiis, praecipue glandulis integris facile distinguenda.

Planta dioecia, succulenta, inermis; radix dense rhizomatosa tuberosa; ramis aeriis brevibus, raro in longitudinem 20 mm attingentibus, singulatim vel in caespites ad spatium extremumque rhizomate exorientibus, spiraliter tuberculatis, estipularibus, variabiliter micro-scabrellis. c. 5 mm crassis.

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Folia carnosa, ovales, acuta, patentes, leviter recurva, plerumque aliquam plicata sed ecarinata, decidua, cicatrice brunnea, prominenti tuberculi ad apicem remanenti. *Inflorescentia* apicalis, axillaris, plerumque cyathio solitario unisexuali in pedunculo bracteato usque ad 7 mm longo portato (in planta feminea brevior); bracteae ovales vel in planta mascula plerumque oblongae, paribus supremis suboppositis saepe gemmis axillaribus insertis. *Cyathium* glabrum; glandulis subquadratis c. 1,5 mm latis, ad apicem leviter rugulosis, aliquam crenulatis, incrassatis, breviter recurvis; lobi subquadrati, c. 1 mm longi, irregulariter dentati, intus extus pubescentes. *Cyathium* masculum aliquanto doliiforme vel urceolatum usque ad 4,5 mm longum, 3,5 mm diam. glandulis inclusis, breviter stipitatum, stipite 2–4 mm longo; floribus plus minusve 20, cum aliquot bracteolis plumosis; pedicelli glabri, antherae maturae non visae. *Cyathium* subsessile, plus minusve cyathiforme, 3,5 mm longum, 4,5 mm latum glandulis inclusis; florum masculorum bracteolarumque vestigiis basi intus praeditis; flos femineus subsessilis; styli c. 2,5 mm longi, in columnam 1,5 mm longam connati, partibus libris patulis, profunde bifidis, lobis late divergentibus recurvis. *Capsula* glabra ex involucri modo exserta, trilobata, late ovoidea, c. 6 mm alta, 7 mm lata. *Semen* ovoideum acutum, 4-angulatum, irregulariter glebulosum, brunneum, 4,5 mm longum, 3 mm diam.

Typus: Richtersveld, Leach, G. & F. Williamson 16545 (NBG, holo.; PRE).



FIG. 1.

Euphorbia miscella Leach. Leach, G. & F. Williamson 16545 from \pm 8 miles S of Lekkersing.

Plant dioecious, unarmed, succulent; *root* densely rhizomatose-tuberos; *aerial branches* spirally tuberculate, estipulate, patchily micro-scabridulous, ± 5 mm thick, seldom attaining 20 mm in length (longer and usually simple in cultivation), arising singly and in small tufts at the ends and at intervals along the rhizomes. *Leaves* fleshy, glabrous, broadly oval, acute, spreading, slightly recurved, usually somewhat folded but not keeled, caducous, leaving a prominent brown scar at the tubercle apex. *Inflorescence* apical, axillary, usually a single unisexual cyathium, borne on a bracteate peduncle up to 7 mm long in the male plant, shorter in the female; bracts oval or in the male plant usually oblong, with the uppermost subopposite pair often subtending axillary buds. *Cyathium* glabrous, *glands* subquadrate, $\pm 1,5$ mm broad, thickened and shortly recurved at the slightly rugulose, somewhat crenulate apex; *lobes* subquadrate, ± 1 mm long, irregularly dentate, pubescent both sides; septa much reduced, dividing into 1 or 2 plumose bracteoles above. *Male cyathium* more or less barrel-shaped or somewhat urceolate up to 4,5 mm long, 3,5 mm diam. including the erect glands, shortly stipitate, stipe 2–4 mm long; flowers ± 20 with a few plumose bracteoles, pedicels glabrous, ± 2 mm long; mature anthers not seen. *Female cyathium* subsessile, more or less cup-shaped, 3,5 mm long, 4,5 mm diam. including the erectly spreading glands, with vestiges of male flowers and bracteoles at its base inside; female flower subsessile, perianth rim-like, sparsely pubescent; *styles* $\pm 2,5$ mm long, united into a column 1,5 mm long, the free portions widely spreading, deeply bifid and the lobes widely diverging recurved, stigmas minutely rugulose. *Capsule* glabrous, finally just exerted from the involucre, 3-lobed, \pm broadly ovoid, ± 6 mm high, 7 mm diam. *Seed* ovoid acute, 4-angled, the dorsal angle rather obscure, irregularly lumpy, brown, 4,5 mm long, 3 mm diam., suture narrowly sharply sulcate.

Although *E. miscella* is described as dioecious it should be mentioned that this is based on the assumption that plants are unisexual. It has not been possible to establish this with certainty as rhizomes were unavoidably broken when extracting specimens from their rocky habitat. However, none has been seen bearing cyathia of both sexes and in view of this and its close affinity with *E. namuskluftensis* it is considered that the assumption is quite justified.

E. miscella is most closely related to the recently described *E. namuskluftensis* and like that species could easily be mistaken for *E. wilmaniae* if the vegetative characters only were considered, but again, like *E. namuskluftensis*, is easily distinguished therefrom when flowering, by its smaller cyathia with entire glands.

The Richtersveld species differs from its South West African relative in its larger oval leaves and its proportionally longer and narrower male cyathi-

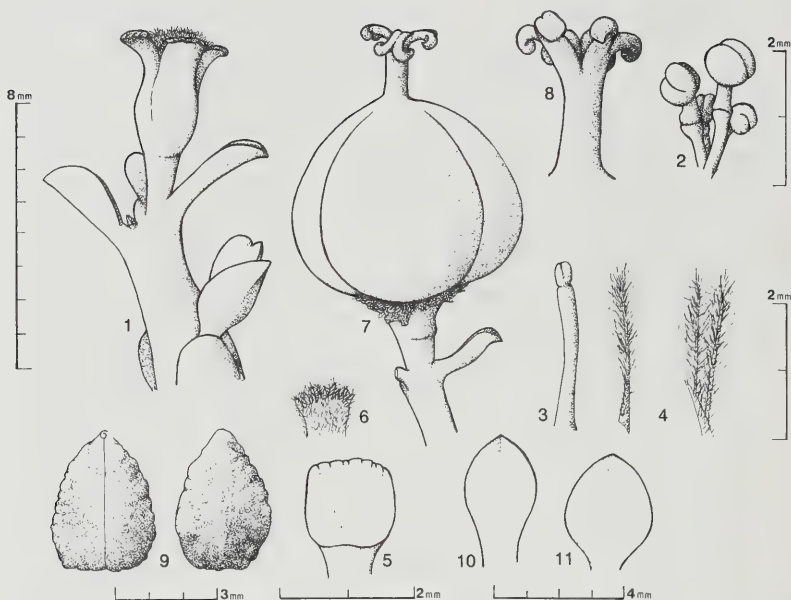


FIG. 2.

Euphorbia miscella Leach. 1, male inflorescence; 2, male flowers (immature); 3, aborted ovary; 4, bracteoles; 5, involucre gland; 6, lobe; 7, capsule; 8, styles; 9, seed; 10, bract; 11, leaf.

um which is borne on a stout stipe; of major importance however, are the entirely different styles of the new species, these are at least twice as long as those of its relative and are united into a more slender column three times as long as in *E. namuskluftensis*. In addition the larger capsule is broadly ovoid in outline and the larger seeds are more heavily and irregularly lumpy.

Additionally to the above differentia it seems possible that *E. miscella* may sometimes develop a dichasial inflorescence, as well-developed buds are sometimes to be seen in the axils of the uppermost peduncular bracts on each side of the base of the cyathial stipe.

Marloth's original specimen (Marloth 12441) was cited as a syntype of *E. wilmaniae*, this erroneous identification apparently resulting from the confusion caused by the addition, three years later, of a cultivated flowering branch of this species to a sterile specimen of *E. miscella* from Lekkersing.

MATERIAL EXAMINED

SOUTH AFRICA, CAPE—2817 (Vioolsdrif): Lekkersing (-CC), 5/9/1925, *Marloth 12441* (PRE) (not including PRE 46364 & 46365 which are mounted on the same sheet but represent *E. wilmaniae*).

—2917 (Springbok): ± 8 miles of Lekkersing (-AA), fr. 9/4/1977, *G & F. Williamson 2515* (K); *ibid.* fl. 23/4/1982, *Leach, G. & F. Williamson 16545* (NBG, holo., PRE) *ibid.* fl. & fr. 10/10/1982, *G. & F. Williamson 3206* (NBG).

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THE GENUS *RUBIA* L. (RUBIACEAE) IN SOUTHERN AFRICA

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ABSTRACT

Three taxa of *Rubia* are represented in southern Africa: *R. cordifolia* subsp. *conotricha* (highly variable and widely distributed in Africa) extends from the (north-) eastern Transvaal, Swaziland and Natal to the eastern Cape. The closely allied species pair *R. petiolaris* and *R. horrida* is confined to southern Africa and is, in turn, related to the first mentioned taxon but is distinguished from it by having leaves arranged in whorls of 6-8(-12) (vs. 4 in *R. cordifolia* subsp. *conotricha*). *R. petiolaris* occurs in the Orange Free State, Lesotho, Natal and the eastern Cape and extends, mostly in coastal areas, to the Riversdale district. *R. horrida* is confined to the drier interior and is recorded from South West Africa (Namibia), south eastern Botswana and Zimbabwe and, in South Africa, from the Transvaal, Natal, Orange Free State and the northern Cape; it is distinguished from *R. petiolaris* by its longer and narrower leaf blades. The first chromosome count for *R. petiolaris* is presented; the published chromosome number of *R. cordifolia* subsp. *conotricha* is confirmed by an additional count; all three taxa are diploid ($n = 11$, $2n = 22$).

UITTREKSEL

DIE GENUS *RUBIA* L. (RUBIACEAE) IN SUIDELIKE AFRIKA

Drie taksa van *Rubia* word in suidelike Afrika verteenwoordig: *R. cordifolia* subsp. *conotricha* (hoogs veranderlik en wydverspreid in Afrika) kom voor vanaf (Noord-)Oos-Transvaal, Swaziland en Natal tot die Oostelike Kaap. Die naverwante spesies-paar *R. petiolaris* en *R. horrida* is beperk tot Suidelike Afrika en is ook verwant aan die eersgenoemde takson maar onderskeibaar deur die blare wat in kranse van 6-8(-12) (vgl. 4 in *R. cordifolia* subsp. *conotricha*). *R. petiolaris* kom in die Oranje-Vrystaat, Lesotho, Natal en Oostelike Kaap voor en strek hoofsaaklik kuslants tot Riversdal. *R. horrida* is beperk tot die droër binneland en is aangeteken vanaf Suidwes-Afrika (Namibië), Suidoostelike Botswana en Zimbabwe en in Suid-Afrika van Transvaal, Natal, Oranje-Vrystaat en Noord-Kaap. Dit word onderskei van *R. petiolaris* deur die langer en nouer blare. Die eerste chromosoomtelling vir *R. petiolaris* word aangebied; die gepubliseerde chromosoom getal vir *R. cordifolia* subsp. *conotricha* word bevestig deur 'n bykomende telling; al drie taksa is diploëid ($n = 11$, $2n = 22$).

Key words: *Rubia*, Rubiaceae.

INTRODUCTION

In continuation of studies on southern African *Rubiaceae* tribe *Rubieae*,

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a short revision of the genus *Rubia* is presented. The most recent comprehensive treatment of South African *Rubia* is that of Sonder (1865) in *Flora Capensis*. When the other genus of the southern African *Rubieae*, *Galium*, was revised (Puff, 1978a), it was detected that one species, *Galium horridum*, needed to be transferred to the genus *Rubia* (Puff, 1978b). Apart from that and a publication of some chromosome counts (Puff, 1978c), no additional information is available.

MATERIAL AND METHODS

Methods for pollen measurements and chromosome counts follow those outlined in Puff (1976, 1978a). Material from the following herbaria was studied: BM, BOL*, COI, GRA*, K, KMG, NBG, NH*, NU, P, PRE, S, SAM, SRGH, UPS, W, WIND, WU (* = not all collections seen). Descriptions: Instead of using the morphologically more precise but awkward term "leaves and leaf-like stipules in whorls of" the description is abbreviated to "leaves in whorls of". *Important*: leaf descriptions and measurements refer to the midstem region of flowering shoots; the lowermost leaves or the youngest leaves on a shoot or leaves of newly produced vegetative shoots may not only differ considerably in size and shape but also in the number of leaves constituting a whorl. Collections: one collection per $\frac{1}{4}$ degree square is cited in full; only collector(s) and coll. no. of additional collections are listed.

For practical reasons, the geographical area covered here extends beyond the *Flora of southern Africa* boundaries: as one of the species confined to southern Africa extends into Zimbabwe, records from that country are also included.

SYSTEMATIC TREATMENT¹⁾

***Rubia* L., Sp. Pl.: 109 (1753) & Gen. Pl., ed. 5: 47 (1754).**

Scrambling, creeping or climbing perennial herbs, somewhat woody near the base; roots quite woody, reddish (yielding a red dye). *Stems* \pm brittle, branched, 4-angled, mostly beset with recurved prickles. *Leaves* in whorls of 4–8(–12), petiolate²⁾, blades cordate or broadly ovate, ovate-lanceolate to linear and rounded to \pm cordate at the base or narrowed to the base, with

¹⁾Descriptions valid for southern African material only.

²⁾The European species *R. peregrina* (with *sessile* leaves) is included in *Flora Capensis* (Sonder, 1865). A *Thunberg* collection of a plant supposedly introduced to the Cape is cited. As I have not been able to trace this or any other collection of *R. peregrina* from South Africa, this species is not included in the present revision.

1–5(–7) prominent veins. *Inflorescences* in axillary and/or terminal cymes. *Flowers* hermaphrodite, 5–(rarely 4– or 6–)merous; corolla greenish, yellowish-green to yellow, rotate to subcampanulate, lobes \pm triangular, (long) acuminate; stamens 5, anthers exerted; ovary 2-locular, with one ovule in each chamber, crowned by a minute disk; style branches 2, joined below; stigmas capitate. *Fruits* fleshy, glabrous, consisting of 2 round mericarps, each with a single seed, round on the dorsal and plane to convex on the ventral side; one mericarp often aborted.

Chromosome number: $x = n = 11$.

KEY TO SOUTHERN AFRICAN TAXA OF *RUBIA*

1. Leaves in whorls of 4 (very rarely in 3 or 5), blades with 5 (–7; very rarely 3) prominent veins; from tropical East Africa to Zimbabwe and Mozambique and, in South Africa, from the Soutpansberg district to Swaziland and from Natal to the eastern Cape 1. ***R. cordifolia* subsp. *conotricha***
Leaves in whorls of 6–8(–12), blades with 3 prominent veins or only a distinct middle nerve; endemic to southern Africa (Namibia, south eastern Botswana and Zimbabwe to South Africa and Lesotho) 2
2. Leaf blades (in the midstem region of flowering shoots) to 25(30) mm long and 5–15 mm wide, cordate or ovate-lanceolate to broadly ovate and rounded to cordate at the base and with 3 prominent veins; leaf blade length to width ratio $< 3:1$ 2. ***R. petiolaris***
Leaf blades (in the midstem region of flowering shoots) to 50(70) mm long and 1–8(10) mm wide, lanceolate to linear, narrowed to the base, only mid-vein prominent; leaf blades occasionally difficult to distinguish from petiole; leaf blade length to width ratio $> 3:1$ 3. ***R. horrida***

1. ***Rubia cordifolia* L. subsp. *conotricha* (Gandoger) Verdc.** in Kew Bull. 30: 323 (1975) et in Fl. Trop. East Afr., Rubiaceae, part 1: 381, Fig. 57 (1976).

Rubia conotricha Gandoger in Bull. Soc. Bot. Fr. 65: 35 (1918). Type: South Africa, [East Griqualand], near Umzimhlawa R., *Schlechter 6550* (LY, holo.; BM, K, S, iso.!).

Rubia longipetiolata Bullock in Kew Bull. 1932: 497 (1932). Type: Kenya, Mt. Elgon, *Lugard 204* (K, holo.!.; EA, iso.).

Rubia cordifolia sensu Sonder in Fl. Cap. 3: 35 (1865).

Stems to 5 m long, c. 1.5–3 mm in diam. in the midstem region, with recurved prickles on the 4 distinct ribs and occasionally also with longish white hairs between the ribs, at least around the nodes. *Leaves* in whorls of 4 (very rarely 3 or 5); blades $27\text{--}55 \times (3)6\text{--}32$ mm, (narrowly) lanceolate to broadly ovate, rounded to cordate at the base, acute to acuminate at the apex, with 5 (7; very rarely 3) prominent veins; margins and veins below with recurved prickles, upper surface \pm glabrous to scabrid, lower surface \pm glabrous or sparsely to \pm densely covered with longish white hairs, blades rarely glabrous altogether; petioles (10)15–60(75) mm long, mostly with re-

curved prickles and occasionally also hairy. *Inflorescences* several- to many-flowered, \pm lax to rather dense; peduncles 1–5,1 mm long, pedicels 1,2–8,6 mm long, glabrous, somewhat pubescent or with small prickles; ultimate bracts c. 1–2 mm long or sometimes absent. *Flowers* 5– (very rarely 6–) merous; corolla 3–5,7 mm in diam., lobes 1,4–2,3 \times 0,6–1,4 mm, often with minute papillae on the margins and near the tip; filaments 0,5–1 mm long, anthers 0,3–0,5 \times 0,2–0,3 mm; ovary c. 0,4–0,8 mm long. *Fruits* dark purple to black, each mericarp 2,7–3,9 mm in diam.

Chromosome Number: $n=11$, $2n=22$ (Puff, 1978c). Additional count: Natal/Transkei border, Umtamvuna bridge [3130-AA], Puff 790424–2/1 (WU): $n=c.11$.

Average Pollen Diam.: 21–25,2 μ m.

Habitat: Mostly at forest edges, in forest clearings, in scrub or bush clumps and in \pm disturbed sites; also in coastal (sand dune) scrub and dune forest; less commonly in grassland or open, rocky areas. Sea level–1 500 m.

Flowering Period: (Dec.–Feb.) March–June (July).

Distribution (map, Fig. 1): Transvaal (Soutpansberg district and along the Drakensberg escarpment), Swaziland, Natal, and in the eastern Cape as far as the East London district. Also in Zimbabwe and Mozambique (included in map, Fig. 1) and extending to tropical East Africa and Angola.

Comments: *R. cordifolia* (extending from Africa to east and south east Asia) is an extremely variable species. It seems most reasonable to follow Verdcourt (1975, 1976) and recognise the relatively more uniform African material from south of the Sahara (apart from Ethiopian plants with distinctly campanulate corollas—“*R. discolor*”) as subsp. *conotricha*. The South African material of subsp. *conotricha* appears to be (relatively) less variable than elsewhere. Two rather distinct “forms” or ecotypes can be distinguished:

A. a “Coastal Form”, occurring from Natal (Tongaland) to the eastern Cape and often growing at the edge of coastal forest, in scrub over sand, etc. It is characterised by having rather succulent, relatively broad, ovate-lanceolate leaf blades with often distinctly cordate bases (cf. Fig. 1), and leaf blades with only few recurved prickles on the margins and/or the veins, or almost glabrous blades (“*R. glabra* Bullock” nom. nud.). Although plants of this entire area are relatively uniform morphologically, they do not appear to be distinct enough to justify formal taxonomic recognition.

B. a “Soutpansberg-Drakensberg Escarpment” or “(North-)Eastern Form”, occurring from the Soutpansberg, Pietersburg and W Letaba district to north west Swaziland. It is distinguished by long petioles and long narrow, lanceolate leaf blades (cf. Fig. 1). The leaves may superficially resemble those of *R. horrida* in shape and size but differ in being arranged in



whorls of 4, by having blades with 5 (rarely 3) prominent veins and by having, on the lower surface, longish white hairs between the veins which in turn are beset with recurved prickles. Similar forms occasionally also do occur in tropical East Africa.

Other southern African collections (especially those from Zimbabwe, Mozambique and the Natal Midlands) are "more typical" *conotricha* and have leaf blades, which in shape are more like the "Coastal Form" and in their indumentum more similar to "form B".

TRANSVAAL—2329 (Pietersburg): Louis Trichardt (-BB), *Breyer s.n.* sub TVL Mus. no. 23439 (PRE); Houtbosh (-DD), *Rehmann* 6030 (K).

—2330 (Tzaneen): Zoutpansberg D., Elim (-AA), *Obermeyer* 501 (PRE); Duiwelskloof, E flank of Piesangkop (-CA), *Scheepers* 973 (K, PRE); Letaba D., Modjadji's Reserve nr. [W of] Duiwelskloof (-CB), *Krige* 162 (PRE).

—2430 (Pilgrim's Rest): The Downs area, Farm Malta (-AA), *Puff* 791209-1/1 (WU); Shilouvane (-AB), *Junod* 754 (K, PRE); Mariepskop, Blyde R. road (-DB), *van der Schijff* 4606 (PRE).

—2530 (Lydenburg): Nelspruit Botanic Garden (-BD), *Kluge* 2293 (NBG).

—2531 (Komatipoort): Kruger National Park, 4 m W of Pretoriuskop (-AB), *Codd* 6014 (K, PRE); Plaston near White River, Farm Cascades (-AC), *Puff* 770112-1/1 (W, WU); Eerste Geluk No. 16 (-CA), *Stirton* 1739 (K, PRE); Barberton (-CC), *Pott* 5596 (PRE), *Rogers* 23762 (PRE).

—2730 (Vryheid): Piet Retief D., Farm Mooihoek (-BA), *Devenish* 1266 (PRE).

Additional collections: *Breyer s.n.* sub TVL Mus. no. 17940 (PRE); *Galpin* 840 (K, PRE \times 2), 11392 (PRE); *Holt* 209 (PRE); *Liebenberg* 2591 (PRE); *Rodin* 4134 (K, PRE); *Scheepers* 664 (BM, K, PRE), *s.n.* (PRE 42030); *Story* 5441 (K, PRE); *van der Merwe* 105 (K, PRE); *van Son s.n.* sub TVL Mus. no. 34832 (PRE); *van Vuuren* 1678 (PRE); *Young s.n.* sub TVL Mus. no. 26523 (PRE).

SWAZILAND—2531 (Komatipoort): Piggs Peak D., Piggs Peak plantations (-CC), *Compton* 27627 (NBG, PRE).

—2631 (Mbabane): Mbabane D., Komati Pass and -bridge (-AA), *Compton* 26947 (K, NBG, PRE), 31509, 32081 (NBG); —, Palwane hills (-AC), *Compton* 25906 (K, NBG, PRE); Hlatikulu D., Mooi Hoek road (-CD), *Compton* 27467 (NBG); —, Kubuta Estate, *Pierce* 26 (PRE).

—2632 (Bela Vista): Lebombo D., 28 km SE of Siteki, Jilobi Forest (-CA), *Kemp* 811 (PRE, WU).

NATAL—2632 (Bela Vista): Tongaland, near Maputa and Big Kosi Lake (-DD), *Rodin* 4668 (K, PRE, S).

—2731 (Louwsburg): Nongoma (-DC), *Gerstner* 1963 (NU \times 2, PRE).

—2732 (Ubombo): Gwalaweni Hills (-AC), *Strey* 8151 (K, NU, PRE); Sordwana Bay (-DA), *Balinhas* 3218 (K, PRE).

—2831 (Nkandla): Hlabisa D., *Aitken & Gale* 27 (NU, PRE); Melmoth (-CB), *Mogg* 6103 (PRE); Eshowe (-CD), *McCLean* 993 (PRE); Ngoye forest (-DC), *Puff* 770125-2/1 (WU); Mtunzini (-DD), *Worsdell s.n.* (K).

—2832 (Mtubatuba): Hlabisa D., Hluhluwe Game Reserve (-AA), *Bouquin* 507 (NU, PRE), *Ward* 2183 (NU, PRE); —, near Hluhluwe village (-AB), *Puff* 760617-5/1 (WU); —, Palm Ridge Farm [N of Mtubatuba] (-AC), *Harrison* 53 (PRE), 462 (K); Between Lake St. Lucia and Indian Ocean (-AD), *Puff* 760610-4/4 (WU); S of Nhlabane (-CB), *du Toit* 1300 (K, PRE); Richards Bay (-CC), *Botha & van Wyk* 1001 (PRE).

—2930 (Pietermaritzburg): Mooi River, Warley Common (-AA), *Mogg* 7235 (PRE)

× 2); Greytown (-BA), *Wylie s.n.* sub. Tvl Mus. no. 33996 (PRE); 9 m NW of New Hanover (-BC), *Codd 1455* (PRE); Pietermaritzburg, Queen Elizabeth Park (-CB), *Puff 760425-1/1* (WU); Richmond D., 5 m out on Hella-Hella road (-CC), *Jacobsen 11* (NU, PRE); Pietermaritzburg D., Table Mountain (-DA), *Killick 333* (NU), *McClellan 181* (PRE); Inanda (-DB), *Medley Wood 528* (K, PRE, SAM); Back Beach (-DD), *Medley Wood 9603* (NBG).

—2931 (Stanger): Stanger Beach (-AD), *Pentz & Acocks 10417* (NBG, PRE); Umhlanga Rocks, Hawaan forest (-CA), *Onderstall 62* (PRE); Blue Lagoon, Durban (-CC), *Forbes & Obermeyer 74* (PRE, SAM).

—3029 (Kokstad): Alfred D., Zuurburg (-BC), *Hilliard & Burt 10185* (K, NU).

—3030 (Port Shepstone): ("Alexandria D."), *Dumisa Stn.*, Ifafa (-AD?), *Rudatis 385* (BM, K, S); Amanzimtoti (-BB), *Adams 53* (NU), *Kotzé 429* (PRE), *Williams 63* (NU); Umdoni Park (-BC), *Guy & Jarman 62, 263* (NU); Oribi Flats (-CA), *McClellan 570* (K, PRE); Port Shepstone (-CB), *Vahrliss 2190* (NBG); Uvongo Beach (-CD), *Liebenberg 8067* (K, PRE); Umzumbe Beach and-R. mouth (-DA), *Puff 761216-2/1* (NU, WU), *Strey 8103* (K, PRE).

—3130 (Port Edward): Port Edward (-AA), *Nicholson 695* (PRE).

Additional collections: *Gerrard 26* (BM, K); *Goossens 1734* (PRE); *Grant s.n.* (K); *Gueinzus 405* (S); *Huntley 205* (NU); "Indian collector" *s.n.* (PRE 42033); *Medley Wood 422* (BM), 6376, 12850 (PRE); *Mogg 1066, 4521, 6919* (PRE); *Pooley 1841* (NU); *Puff 790424-2/1* (BR, J, WU); *Rehmann 8936* (BM, K); *Salter 382/11* (BM); *Schlechter 2771* (PRE); *Strey 10875* (PRE); *Vahrmeijer & Tölken 940* (K, PRE); *Ward 251* (NU, PRE); *Whatmough (?Klatnagh) 482* (K, PRE); *Wylie s.n.* sub TVL Mus. no. 33998 (PRE).

CAPE—3029 (Kokstad): Mt. Currie (-AD), *Tyson 1583* (K, SAM; PRE- mixed with *R. petiolaris*); Kokstad (-CB), *Mogg 5116* (PRE).

—3129 (Port St. Johns): Port St. Johns (-CB), *Brueckner & Allsopp 119* (NU); Near Mtata (= Umtata) R. mouth (-CC), *Puff 790414-2/1* (WU).

—3228 (Butterworth): Komga D., 8 m from Kei mouth (-CB), *Sidey 644* (S).

—3327 (Pieddie): East London D., Cove Rock Beach (-BB), *Comins 1539* (PRE).

Without precise locality: "C.B.S.", *Wahlberg s.n.* (S).

Additional collections: *Compton 16983* (NBG); *Pegler 378* (PRE: *R. petiolaris* in other herbaria), 412 (SAM; BM- mixed with *R. petiolaris*); *Puff 790415-6/1* (BR, J, NU, WU); *Salter 379/27* (BM); *Schlechter 6550* (BM, K, LY, S); *Tyson 1262* (PRE).

2. *Rubia petiolaris* DC., *Prod.* 4: 588 (1830). Type: South Africa, Cape Prov., [Port Elizabeth D.], around Krakakamma, *Burchell 4561* (K!, 2 sheets; Fig. 2a).

Rubia petiolaris var. *isophylla* Sonder in *Fl. Cap.* 3: 35 (1865). Syntypes: South Africa, Cape Prov., [Mündung des] Zwartkopsrivier, *Zeyher 2721* (S, lecto!, selected here); —, —, nr. Algoa Bay, Port Elizabeth, *Ecklon & Zeyher 2320* (S!); SAM!— 2 sheets, one mixed with *R. cordifolia* subsp. *conotracha*; —, —, Port Elizabeth, *Drège s.n.* (as "*R. petiolaris* DC."); K!, S × 2!, SAM!; —, 'CBS', *Thunberg s.n.* ("*R. cordifolia* L."; ?S, several sheets).

Stems to c. 3 m long, c. 1.5–2.5 mm in diam. in the midstem region, with recurved prickles on the 4 distinct ribs and at least younger parts often with hairs below the nodes, otherwise glabrous or occasionally also with some short whitish hairs between the ribs. *Leaves* in whorls; blades

8–25(30) × 5–15 mm, cordate or ovate-lanceolate to broadly ovate and rounded to cordate at the base, acute at the apex, with 3 prominent veins; margins and at least midvein below with recurved prickles, rarely scabrid and/or with prickles above; petioles 10–30(35) mm long, mostly beset with (2 rows of) recurved prickles. *Inflorescences* few- to several-flowered, rather lax; peduncles 1,2–4,8 mm long, pedicels 1–4,4 mm long, glabrous or (seldom) somewhat hairy; ultimate bracts c. 2–4 mm long. *Flowers* 5– (very rarely 4–) merous; corolla 3–5 mm in diam., lobes 1,2–2,2 × 0,7–1,1 mm, occasionally with minute papillae on the margins; filaments 0,3–0,7 mm long, anthers 0,2–0,4 × 0,1–0,2 mm; ovary c. 0,5–0,9 mm long. *Fruits* blackish, each mericarp c. 2,4–3 mm in diam.

Chromosome Number: $n=11$, $2n=22$. Cape Prov., east of New England Station, on road to Lundeans Nek Pass [3027–DC], Puff 790112–12/1 (BR, J, NU, WU). First count for the species.



FIG. 2.

a–b: photographs of (a) *R. petiolaris* (type: Burchell 4561, K) and *R. horrida* (type of *R. petiolaris* var. *heterophylla*: Zeyher 774, K); c: *R. horrida*, new shoot arising from near the base of a cultivated plant (Puff 790516–1/1); note relatively broad leaves and leaf pairs larger than the other leaves of a whorl; further explanations in the text. The scale is in mm.

Average Pollen Diam.: 19,5–20,8 μm .

Habitat: Mostly between or under shrubs in scrub or forest margin vegetation; occasionally in open grassy areas among rocks or in \pm moist situations among tall grass and shrubs; in the south west in coastal fynbos (sometimes over limestone) or in sand dunes. Ca. 15–2 200 m.

Flowering Period: Nov.–March (April–June).

Distribution (map, Fig. 4): From the Orange Free State, Lesotho, south west Natal and the eastern Cape south west to the Riversdale district.

Comments: *R. petiolaris* is rather variable both morphologically (especially leaf size and shape—cf. Fig. 4) and ecologically (occurring from coastal fynbos to afro montane areas and covering an altitudinal range of more than 2 000 m). Forms collected on the Cape coast from the Alexandria district to the westernmost locality of the species (Still Bay) are often quite distinct in having rather round and broad leaf blades (cf. type photograph, Fig. 2a; Fig. 4); leaf blade length to width ratios are the lowest recorded (0,9:1 to 2:1; Fig. 3). In addition, these collections frequently have whitish hairs between the angles/ribs of the stems. Differences are, however, not good and reliable enough to justify formal taxonomic recognition.

Mixed collections from a few localities (eastern Cape to East Griqualand) seem to indicate that *R. petiolaris* and *R. cordifolia* subsp. *conotricha* can apparently occur together. The taxa, however, are easily separated by their leaf arrangement (whorls of 6–8 vs. 4 respectively); there is no evidence for the occurrence of hybrids.

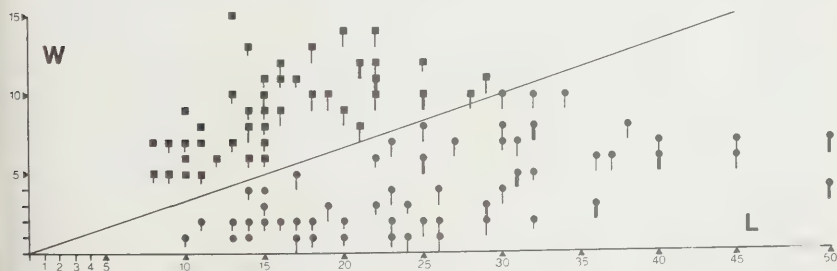


FIG. 3.

Leaf length (L) to width (W) ratio of *R. petiolaris* (■) and *R. horrida* (●). Vertical lines below the symbols refer to petiole lengths of the respective leaves: –10 mm: no line; 11–20 mm: short line; 21–30 mm: long, thin line; > 30 mm: long, thick line. Only well-developed leaves from the midstem region of flowering shoots were measured. L and W in mm; L:W ratios are <3:1 above the diagonal and >3:1 below.

R. petiolaris is, without doubt, very closely allied to *R. horrida*. In parts of the Cape, namely from the Orange River (Colesberg to Aliwal North districts) south to the Graaff-Reinet and Cradock districts (but usually not elsewhere) the two are sometimes difficult to separate, especially if no good flowering material is available. Rather narrow-leaved forms of *R. petiolaris* may somewhat approach *R. horrida*. See also *R. horrida*, "Comments".

ORANGE FREE STATE—2828 (Bethlehem): Witsieshoek (-DB), *Junod s.n.* sub Tvl Mus. no. 17479 (PRE).

—2829 (Harrismith): Harrismith (-AC), *Sankey 81* (K); —, Platberg, *Hahn s.n.* (NBG 92780).

—2926 (Bloemfontein): Thaba Nchu D., Thaba Nchu Mt., Cave Kloof (-BB), *Roberts 2288* (PRE; atypical-vegetative).

—3025 (Colesberg): c. 10 miles E of Norvalspont, along Orange R. (-DA), *Werger 1026* (PRE; atypical-vegetative).

NATAL—2929 (Underberg): Coleford Nature Reserve, Sunnyside Cottage (-CD), *Puff 761225-1/3* (WU); (I)Mpendle D., Upper Umkomaas (-DB?), *Killick & Vahrmeijer 3705* (K, PRE); Polela D., Sunset Farm (-DC), *Rennie 795* (NU).

LESOTHO—2828 (Bethlehem): Leribe (-CC), *Dieterlen 331b* (K, NBG, PRE, SAM).

—2927 (Maseru): Mamathes (-BB), *Guillarmod 871* (PRE); Roma, near Roma R. (-BC), *Schmitz 208* (PRE).

—2929 (Underberg): Mokhotlong (-AC), *Compton 21491* (NBG), *Guillarmod 1052* (PRE).

—3027 (Lady Grey): Thaba Tsueu (-AB), *Pogc s.n.* (PRE 42049).

Additional collections: *Guillarmod 38* (PRE); *Kitching s.n.* (K); *Schmitz 421*, 435, 6358, 8437, 8530 (PRE); *Williamson 766* (K).

CAPE—3026 (Aliwal North): Caledonsfontein, P.O. Knapdaar Stn. (-CA), *van der Vyver 3* (PRE); Aliwal North D., Eland's Hoek (-DA), *Bolus 10530* (K; \pm atypical); "Mooy plaats" (-DC¹), *Drège 7669* (K, PRE- \pm approach *R. horrida*).

—3027 (Lady Grey): Lady Grey D., Witteberg, rd. to Joubert's Pass (-CA), *Hilliard & Burt 12147* (NU, S, WU); E of New England Stn., on rd. to Lundean's Nek Pass (-DC), *Puff 790112-12/1* (BR, J, NU, WU).

—3029 (Kokstad): Mt. Currie (-AD), *Tyson 1583* (PRE-mixed with *R. cordifolia* subsp. *conotricha*; as "near Kokstad"—SAM \times 2).

—3124 (Hanover): Richmond D., Roelofsfontein (-DA), *Hanekom 1938* (K; PRE- \pm approach *R. horrida*).

—3126 (Queenstown): Queenstown D., Fincham's Nek (-DD), *Galpin 1752* (PRE \times 2).

—3127 (Lady Frere): Wodehouse D., Clarksdale, Dordrecht (-AC), *Taylor 5647*, 5659 (NBG).

—3128 (Umtata): Tsitsariver (= falls?; -BD), *Krook 2049* (S).

—3224 (Graaff-Reinet): Nr. Graaff-Reinet (-BC), *Bolus 226* (BM, K- \pm atypical; approach *R. horrida*).

—3225 (Somerset East): Cradock D., Mountain Zebra National Park (-AB), *Brynard 169* (PRE); Boschberg near Somerset East (-DA), *Macowan 1559* (BM).

¹ The grid reference in Leistner & Morris (1976; 3026-CC) is probably incorrect. The collection (locality I, a, 38, from 5000–6000 ft.!, cf. Drège, 1843) probably originated from above Farm Mooiplaas on the (N)W foot of the Stormberg (= -DC).

—3226 (Fort Beaufort): Shiloh (-BB), *Baur* 916 (K); Victoria East D., Seymour, Hogsback, Kaffirkop (-DB), *Giffen* 1095 (PRE); Around Fort Beaufort (-DC), *Ecklon & Zeyher* "31-6" (S); Victoria East D., Alice, Univ. of Fort Hare grounds (-DD), *Giffen* 815 (PRE).

—3227 (Stutterheim): Foot of Amatolas on Hogsback-Alice rd. (-CA), *Wells* 3663 (K, PRE); Stutterheim commonage (-CB), *Acocks* 9539 (K, PRE); Pirie (-CC), *Sim* 2849 (NU); Near Komgha (-DB), *Flanagan* 1270 (COI, NBG, PRE, SAM).

—3228 (Butterworth): Kentani D. (-CB?), *Pegler* 378 (BM, K), 412 (PRE; BM-mixed with *R. cordifolia* subsp. *conotricha*).

—3322 (Oudtshoorn): Oudtshoorn (-CA), *Britten* s.n. sub Tvl Mus. no. 12454 (PRE).

—3325 (Port Elizabeth): Port Elizabeth D., around Krakakamma (-DC), *Burchell* 4561 (K); —, Humewood (-DC), *Dahlstrand* 674 (PRE), *Paterson* s.n. sub Tvl Mus. no. 25792 (PRE).

—3326 (Grahamstown): Grahamstown (-BC), *Glass* 829 (NBG); Alexandria D., De Mond (-CA), *Archibald* 4065 (PRE); —, NE of Woody Cape (-CD), *Johnson* 838 (PRE).

—3421 (Riversdale): Riversdale D., Still Bay (-AD), *Horn* s.n. (PRE 42050), *Muir* 121 (PRE), *Taylor* 176 (NBG); Ystervarkfontein-Albertinia rd., c. 5–7 km from Farm Driefontein (-BC), *Puff* 790910–5/2 (NU, WU).

—3422 (Mossel Bay): George D., Mt. Pleasant (-AB), *Martin* 117 (NBG); Knysna D., Goukamma Nature Res. (-BB), *Reyneke & students* 188 (PRE).

—3423 (Knysna): Knysna D., Rooi storm (-AA), *Marloth* 7371 (PRE); —, Keurboomstrand (-AB), *Taylor* 4411 (PRE).

—3424 (Humansdorp): Eerste River (-AA), *Thode* A857 (PRE); Humansdorp D., Klipdrift (-BA), *Thode* A2476 (K, PRE).

Without precise locality: "C.B.S.", *Masson* s.n. (BM), *Sparman* s.n. (S × 2), Thunberg "480", "4.480", s.n. (S).

Additional collections: *Acocks* 11104 (K, PRE); *Bowie* s.n. (K); *Cooper* 1357 (BM, K); *Drège* s.n. (K, S × 2, SAM); *Ecklon & Zeyher* "93.12" (PRE), 2320 (S; SAM × 2— one sheet mixed with *R. cordifolia* subsp. *conotricha*); *Hugo* 1111 (PRE); *Kuntze* s.n. (K); *Prior* s.n. (K); *Taylor* 6017 (NBG); *Zeyher* 2721 (S), 2721a (SAM), s.n. (S).

3. *Rubia horrida* (Thunb.) Puff in Kew Bull. 32: 432 (1978).

Galium horridum Thunb. in Hoffmanns Phytograph. Blätter 1: 16 (1803) et Fl. Cap. 1: 556 (1813); Sonder in Fl. Cap. 3: 37 (1865). Type: South Africa, Cape Prov., *Masson*, herb. Thunberg 3323 (UPS, holo.).

Rubia petiolaris DC. var. *heterophylla* Sonder in Fl. Cap. 3: 35 (1865). Types: South Africa, [OFS], on the Great Vetrivier (Fat R.), *Burke & Zeyher* 774 [*Burke* s.n. (K, iso.), *Zeyher* s.n. (sub SAM 16074, iso.); S, holo.) and 774 (BM, K, iso.; Fig. 2b)].¹⁾

¹⁾ The collections originate from a Burke and Zeyher joint expedition (see Gunn & Codd, 1981, for details). Specimens are often attributed to one or the other collector; collection numbers of supposed Burke or Zeyher collections from one and the same locality often are not identical or no collection numbers at all are given. Apparently Burke and Zeyher did not settle on joint collection numbers before Burke's return to England after the expedition. The sheet is S bears a label in Sonder's handwriting and is, therefore, considered to be the holotype.

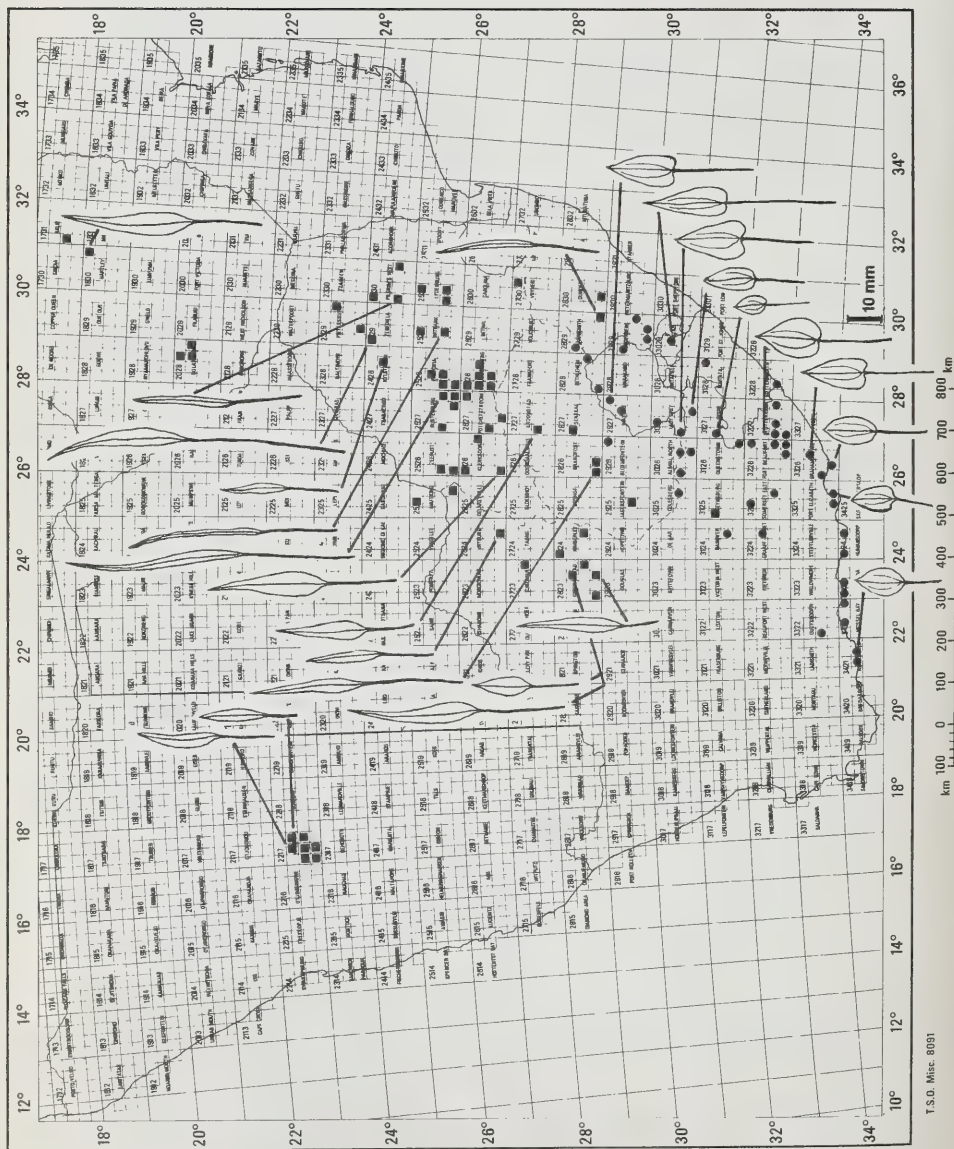


Fig. 4. Distribution and leaf shapes of *R. petiolaris* (●) and *R. horrida* (■).

Stems to c. 2–3 m long, c. 1,5–2,5 mm in diam. in the midstem region, with recurved prickles on the 4 distinct ribs and at least younger parts often with short hairs below the nodes, otherwise glabrous or occasionally also with some short whitish hairs between the ribs. *Leaves* in whorls of 6–8 (–12), blades (8)12–50(70) × 1–8(10) mm, lanceolate, linear-lanceolate to linear, ± rounded at the base or more commonly narrowed to the base, blades occasionally difficult to distinguish from the faintly winged petioles, acute at the apex, only midvein prominent; margins and midvein below with recurved prickles, seldom scabrid above; petioles (6)10–35(45) mm long, ± 3-angular in section or somewhat canaliculate, mostly beset with (2 rows of) recurved prickles. *Inflorescences* several- to many-flowered, rather lax to ± dense; peduncles 1–5(6,5) mm long, pedicels 1,5–6 mm long, glabrous or sometimes slightly hairy; ultimate bracts c. 2–5 mm long, linear. *Flowers* 5– (very rarely 4– or 6–)merous; corolla 3–5,9 mm in diam., lobes 1,2–2,4 × 0,8–1,2 mm, often with minute papillae on the margins; filaments 0,3–0,6 mm long, anthers 0,3–0,5 × 0,1–0,2 mm; ovary c. 0,4–0,8 mm long. *Fruits* blackish or dark purple, each mericarp (2,2) 2,5–3,7 mm in diam.

Chromosome Number: $n = 11$, $2n = 22$ (Puff, 1978c).

Average Pollen Diam.: 18,9–21,4 µm.

Habitat: In bush clumps in open grassland, in thornveld or *Acacia* scrub, in *Acacia caff-a-Protea* woodland; occasionally on rocky outcrops or in riverbank vegetation or in dried up riverbeds. Mostly growing in (shallow) sandy, sandy-loamy or stony soil; less commonly in kalkveld. Ca. (600) 1 000–1 800 (2 100) m.

Flowering Period: (Nov.) Dec.–March.

Distribution (map, Fig. 4): From Zimbabwe (*Flora Zambesiaca* areas C and W), south east Botswana and Namibia (Windhoek Bergland) to the Cape, Orange Free State, Natal (Weenen and Estcourt districts) and the Transvaal.

Comments: *R. horrida* shows a marked leaf dimorphism. Leaves of new shoots or the lower leaves of flowering shoots may have broad and sometimes quite large blades, while other shoots only have leaves with very narrow and long blades (midstem leaves of flowering shoots!). Blades (especially in numerous Transvaal collections) may be so narrow that it is not always easy to distinguish the blades from the sometimes faintly winged petioles (for this reason, the leaves have sometimes, incorrectly, been described as sessile and linear). Sonder (1865) noted this dimorphism and described these plants as *R. petiolaris* var. *heterophylla* but failed to note that they were identical to "*Galium horridum*". I have grown *R. horrida* from seed (Puff 790516-1/1) and was able to observe this change in leaf size and shape over several years. After flowering or fruiting, the shoots with

narrow leaves die back and new shoots develop from innovation buds near the somewhat woody base of the plant. At first, the leaves are rather broad and are similar to those of *R. petiolaris* (Fig. 2c), but later in the season, when the shoots start to flower, the leaves become markedly narrower (as in Fig. 2b). Perhaps these initial broad leaves point to and support the close genetic link between *R. horrida* and *R. petiolaris*.

It is recommended that leaf blade length to width (L:W) ratios rather than length and width ranges are used to identify "critical" specimens. *R. horrida* has L:W ratios of 3:1 to 26:1 (Fig. 3; compare with *R. petiolaris*). In addition, *R. horrida* leaf blades have only one prominent vein, namely the midvein (although broader-leaved forms may have an additional faint vein on either side of the midvein, which, however, should not be mistaken for the three prominent veins on *R. petiolaris* leaf blades); blades are mostly narrowed to the base (rather than rounded or cordate); bracts of *R. horrida* are linear to linear-lanceolate, those of *R. petiolaris* are broader. Variability in leaf size and shape is documented in Figure 4.

R. horrida appears to occur in generally drier and hotter areas than *R. petiolaris*. This also holds true for the seemingly "out of place" Natal localities (plants appear to be confined to lower lying "thornveld" areas of "Weenen County"; cf. West, 1951). The presently known, rather disjunct distribution range (Fig. 4) may not be a true reflection of the actual distribution area of the species but may be due to undercollecting in parts of Namibia, the northern Cape, Botswana and Zimbabwe.

SOUTH WEST AFRICA (NAMIBIA)—2217 (Windhoek): Windhoek D., Farm Voigtskirch 135, 15 km NW of Seeis (-AD), *Kers* 2521 (S); —, Farm Bodenhausen (-BC), *Seydel* 1836 (COI, K, WIND), 2696 (K, US); Immental (-CA), *von Koenen* 483 (WIND); Farm Finkenstein 71 (-CB), *Seydel* 4235 (K, US), *Wanntorp & Wanntorp* 182 (K, S); Lichtenstein (-CC), *Dinter* 3522 (BM, K, PRE), 4336 (S); Farm Binsenheim/Rietfontein, WIN 85 (-CD), *Volk* 11172 (WIND); Farm Koanus, WIN 121 (-DA), *Giess* 9611 (WIND).

BOTSWANA—2525 (Mafeking): Ga-Ngwaketse, Kanye (-AB), *Kelaole* A97 (SRGH).

ZIMBABWE—1731 (Salisbury): Salisbury D., Calgary Farm (-CA), *Howard Williams* 37 (K, SRGH); —, Salisbury, *Wild* 642 (K).

—1830 (Hartley): Beatrice (-BB), *Brain* 9693 (SRGH), *Eyles* 4431 (K).

—2028 (Bulawayo): Bulawayo (-BA), *Gardner* 8 (K); Matopos Res. Stn. (-BC), *Kennan* 222 (SRGH); Matopos, *Rogers* 5684 (BM, K, SAM); Umzingwane D., 10 km from Essexvale on Bulawayo rd. (-BD), *Mavi* 1536 (K, SRGH).

SOUTH AFRICA, TRANSVAAL—2329 (Pietersburg): Between Bandelierkop and Soekmekaar (-BD), *Puff* 770107-1/10 (WU); Pietersburg Nature Res. (-CD), *Bredenkamp & van Vuuren* 297 (PRE).

—2428 (Nylstroom): Sterkrivierdam Nature Res. (-BC), *Jacobson* 2212 (PRE).

—2429 (Zebediela): Percy Fyfe Nature Res. (-AA), *Huntley* 1466 (PRE), *Puff* 770105-1/1 (W, WU).

—2430 (Pilgrim's Rest): Letaba Forest Res., track to Wolkberg Mt. Hut (-AA), *Puff* 770108-1/1 (W, WU); Lydenburg D., 60 m NW of Lydenburg, Farm Schoonoord

(-CA), *Barnard* 57a, 57b (PRE); Path to Bourke's Luck Gold Mine (-DB), *Puff* 790701-1/5 (WU).

—2527 (Zeerust): Zeerust (-CA), *Jenkins* 11681 (PRE), *Thode* A1422 (NH); Lichtenburg D., Malopo's Oog (-CC), *Botha* 2659 (PRE).

—2527 (Rustenburg): Rustenburg (-CA), *Leendertz* 9759 (PRE), *Rogers* 22327 (BOL, GRA, PRE); Brits D., De Kroon's Farm (-DB), *Stent s.n.* (PRE 42031); Krugersdorp D., Jack Scott Private Nature Res. (-DC), *Wells* 2409 (K, PRE); Brits D., Scheerport (-DD), *van Vuuren* 554 (K, PRE).

—2528 (Pretoria): Roodeplaatdam Nature Res. [NE of Pretoria] (-AD), *van Rooyen* 2613 (PRE); Pretoria, Meintjes Kop (-CA), *Burtt-Davy* 3070 (K, PRE), 5012 (PRE); Zwavelsoort, 16 m E of Pretoria (-CB), *Mauve* 24 (NU); Doornkloof, Irene, S of Pretoria (-CC), *Gillett* 3241 (K).

—2529 (Witbank): Groblersdal D., c. 4 m N of Groblersdal (-AB), *Mönnig* 68 (PRE); Middelburg, Farm Doornkop 273 JS (-CB), *du Plessis* 801, 22242 (PRE).

—2530 (Lydenburg): Lydenburg (-AB), *Barnard* 7 (K), *Rogers* 14563 (K); Hartbeest Spruit (-CA), *Watt & Brandwyk* 657 (PRE); Waterval Boven (-CB), *Rogers* 12237 (PRE).

—2626 (Klerksdorp): 3 m N of Lichtenburg on Zeerust rd. (-AA), *Scheepers* 1488 (PRE); Ventersdorp D., Goedgedacht (-BD), *Sutton* 518 (PRE × 2); Wolmaransstad D., Welgelegen (-CC), *Hanekom* 1805 (PRE).

—2627 (Potchefstroom): Krugersdorp D., Kromdraai Farm (-BB), *Mogg* 34038 (PRE); Potchefstroom D., Boskop (-CA), *Louw* 658 (PRE); —, c. 15 km from Schoemansdrift (-CD), *de Feijter* 116 (PRE).

—2628 (Johannesburg): Johannesburg D., Orange Grove (-AA), *Lamb* 3817 (SAM); Monroer Hills, 12 m S of Johannesburg (-AC), *McMurty* 14 (NBG); 25 radial miles SE of Johannesburg, Farm Schoongezicht 64 (-AD?), *Mogg* 22889 (PRE); Uitkyk Farm, 43 radial miles SE of Johannesburg, 10 m SE of Nigel (-BC), *Mogg* 18979 (K); Heidelberg D., Suikerbosrand Nature Res. (-CA), *Lambrechts* 228 (PRE); —, —, entrance at Nolte B2 (-CB), *Bredenkamp* 373 (PRE).

—2730 (Vryheid): Piet Retief D., Farm Mooi Hoek (-BA), *Devenish* 1507 (PRE; ± atypical).

Additional collections: *Burtt-Davy* 181, 14501 (PRE); *Coetzee* 276 (PRE); *Comins* 918 (K, PRE); *Galpin* 8991 (K, PRE); *Gilmore* 494 (PRE); *Howlett* 750 (PRE); *Jacobson* 805 (PRE); *Jenkins* 11202 (PRE); *Leendertz* 429, 742 (PRE); *Mogg* 883 (PRE), 12499 (K, PRE), 15738 (NH, PRE); *Morris* 1127 (PRE); *Moss* 6837, 8529, 10992 (BM); *Nation* 84 (K); *Puff* 790516-1/1 (BR, J, NU, WU); *Repton* 211 (PRE), 2047 (K, PRE); *Rogers* 5863 (PRE); *Sanderson s.n.* (K); *Schlieben* 7718 (K); *Theiler* 9617 (PRE); *van Warmelo* 65 (PRE); *Verdoorn* 791 (PRE); *Watt* 5004 (K); *Watt & Brandwyk* 1812 (PRE); *Zeyher* 771 (BM, K).

ORANGE FREE STATE—2727 (Kroonstad): Kroonstad D., Kroonstad (-CA), *Pont* 452 (PRE), *Scheepers* 1722 (K, PRE).

—2826 (Brandfort): Bloemfontein D., Krugersdriftdam Nature Res. (-CC), *Muller* 1599 (PRE); —, Glen, School of Agriculture (-CD), *Potgieter* 19 (PRE).

—2827 (Senekal): Willem Pretorius Wildtuin (-AC), *Muller* 843 (PRE).

—2925 (Jagersfontein): Fauresmith, Riet R. (-CB), *Henrici* 2449 (PRE).

Without precise locality: Modder R. ("Diamond fields and OFS"), *Barber (?Barker)* 8 (K); Groot Vet R., *Burke s.n.* (K), *Zeyher* 774 (BM, K), *s.n.* (S, SAM 16074).

NATAL—2829 (Harrismith): Estcourt D., between Estcourt and Rensburg Spruit (-DD), *Acocks* 10125 (NH, PRE).

—2830 (Dundee): Weenen D., Mudén (-CD), *Sim* 19076 (PRE).

Without precise locality: Lower Mooi R., *Bews s.n.* (NU 2847); "Natal", *Gerrard (& Mc'Ken)* 1339 (BM, K).

- CAPE—2525 (Mafeking): (-DC), *Duparquet 103* (P).
 —2624 (Vryburg): Vryburg (-DC), *Mogg 8506* (PRE).
 —2723 (Kuruman): S of Takun (-BD), *Burchell 2230* (K; atypical-vegetative).
 —2823 (Griekwastad): Hay D., Papkuil (-BC), *Wilman 1899* (KMG, SAM); —, Griquatown (-CC), *Burchell 1948* (K); Barkly West D., kalkveld at Middelpos (-DB), *Acoks 2115* (K, KMG, PRE); Herbert D., Campbell Kloof (-DC), *Wilman 1403* (K, KMG, PRE), *s.n.* (PRE 42061).
 —2824 (Kimberley): Barkly West D., Farm Wolwefontein (NW 56) (-AA), *Acoks 701* (PRE); —, Klip Vlei (-DA), *Ferrar 6631* (KMG).
 —3125 (Steynsburg): Middelburg (-AC), *Theron 127* (PRE).
 Without precise locality: "Kaffraria", *Burt-Davy 13050* (PRE \times 2); Kuil, *Marloth 1017* (PRE \times 2); Middelburg D., Onbekend, von Bülow's Farm (3124/3125?), *Verdoorn 1559* (PRE).

NOTE ADDED IN PRESS

During a recent visit to the herbarium at Universidade E. Mondlane in Maputo (LMU), two new records of *R. cordifolia* subsp. *conotricha* for southern Mozambique (Maputo Province) were found:

Namaacha, Ave. Gov. Augusto Vez Spencer em direct. à Matianine [2532-CC], *Marques 2761*.

Lagao Satine, próx do Zitundo [2632-DB, -DD], *Correia & Marques 2178*.

The first-mentioned collection (not included in map, Fig. 1) corresponds to "form B" (see *R. cordifolia* subsp. *conotricha*, "Comments"), the second is a "Coastal Form", very similar to collections from nearby Natal (Tongaland).

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NOTES ON THE GENUS *MESEMBRYANTHEMUM* L.

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ABSTRACT

The history of the nomenclature and typification problem of *Mesembryanthemum* is reviewed. The taxonomic position of the genus is briefly outlined. A new name, *M. horridum*, is given for the homonym *M. setosum* (L.Bol.) L.Bol. A discussion of a possible infrageneric structure is included.

UITTREKSEL

AANTEKENINGE OOR DIE GENUS *MESEMBRYANTHEMUM* L.

Die geskiedenis van die probleem rondom benaming en tipering van *Mesembryanthemum* word hersien. Die taksonomiese posisie van die genus word kortliks geskets. 'n Nuwe naam, *M. horridum*, is vir die homoniem *M. setosum* (L.Bol.) L. Bol. gegee. 'n Bespreking van 'n moontlike infragenerieke struktuur word ingesluit.

Key words: *Mesembryanthemum*, lectotype, Mesembryanthemaceae, nom. nov., western Cape.

INTRODUCTION

In the course of research for a revision of the genus *Delosperma* N.E.Br. by the second author, a homonym in the genus *Mesembryanthemum* was discovered which is in need of a previous or new name. It is not surprising to find a homonym considering that over 1 000 specific epithets have been proposed in the genus *Mesembryanthemum*. The vast majority of these names have been transferred to the over 100 segregate genera described by N.E. Brown, H.M.L. Bolus, G. Schwantes and a few others. The genus *Mesembryanthemum* L. as emended by Bolus (1939) is now restricted to approximately 40 species. It is this current interpretation of the genus which is of concern in this note.

GENERIC HISTORY

The genus *Mesembrianthemum* was originally proposed by Breyne (1689) who referred to the afternoon opening of the flowers in the name. The spelling was later changed from the original *Mesembrianthemum* to *Mesembryanthemum* by Dillenius (1732) who changed the meaning of the name as

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well (to "a flower with the pistil in the centre"—not a very distinctive meaning). In this same work, Dillenius discussed the history of the group up until his own time and provided a dichotomous key to individual species and species groups.

Linnaeus is credited as the author of the genus in modern plant taxonomy since all nomenclature dates only from his *Species Plantarum* (1753). Bolus (1928) attributed the original name (and spelling) to Hermann and the spelling change to Linnaeus. But this is completely incorrect as Hermann's last work (published posthumously in 1698) still used the ancient *Ficoides* in place of *Mesembryanthemum*, and none of Linnaeus' major botanical works predate Dillenius' publication. An accurate account of the early history of the name *Mesembryanthemum* is presented in Jacobsen (1960) and in Herre (1971).

The concept of the genus as encompassing all plants which are termed "vygies" or "ice-plants", as intended by Linnaeus, lasted almost two-hundred years until the early part of this century. It was through the work of N.E. Brown that the separation of this group of plants into many genera based primarily on fruit characters was initiated. The use of fruit or capsule characters to segregate the many genera of the family Mesembryanthemaceae (Aizoaceae *sensu lato*) continues today although there are at present attempts to utilise epidermal characters to refine the current classification of the family (Ihlenfeldt and Hartmann, 1982).

After the removal from *Mesembryanthemum* of numerous species into other genera, a new definition of the genus was required. The first to provide such an emended description of the genus *Mesembryanthemum* was Brown (1925a) who very clearly and precisely chose *M. umbellatum* (*Ruschia umbellata* in current nomenclature) as the lectotype of his refined genus. With his selection of a lectotype for *Mesembryanthemum* and the simultaneous publication of a key to the many newly separated genera (1925b), Brown began a rivalry which spanned the two hemispheres and involved G. Schwantes in Germany and H.M.L. Bolus in South Africa, all three major contributors to our knowledge of the Mesembryanthemaceae.

Schwantes was the first to object to Brown's lectotypic choice (1927) by discovering that the characters of *Mesembryanthemum umbellatum* did not match the characters of *Mesembryanthemum* in Brown's published key (i.e. the presence of a tubercle in the fruit of *M. umbellatum* and the lack of such under *Mesembryanthemum* in the key). Thus convinced that Brown's error was taxonomically and/or nomenclaturally unsatisfactory, Schwantes chose a new lectotype for *Mesembryanthemum* in *M. tenuifolium* (*Lampranthus tenuifolius* in current nomenclature). Brown admits his error as being a mistake in the key (1930) but justifiably claims that the error in no way invalidates his lectotype for the genus.

Bolus took offence to the type selections of both Brown and Schwantes. Not to be outdone by her European counterparts, she decided to declare her own choice for a lectotype of *Mesembryanthemum* as *M. nodiflorum* (1939). She published her opinion in spite of a personal letter from Schwantes in August 1935, suggesting that she not publish another type for *Mesembryanthemum* and therefore create even more nomenclatural nightmares than previously existed. Bolus disclaims Brown's choice on account of his supposed misinterpretation of the Linnaean description of the genus but her argument for her choice seems no more convincing than his. Possibly because Brown had died prior to Bolus' publication and her strong influence on research in the family, it is this last emended description by Bolus which attracted the most support.

Unfortunately, the matter could not rest with the Bolus definition of the genus because under the *International Code of Botanical Nomenclature* (Article 11; Stafleu, 1978), the earliest validly published work takes precedence. Consequently Ihlenfeldt and Straka (1972) proposed to have *Mesembryanthemum* L. emend. L. Bol. conserved over both emendations of the genus by Brown and Schwantes. Their proposal was approved (McVaugh, 1974) although the reasons supporting the approval seem inconclusive. The committee suggests that the Bolus concept is in well-established usage and the Brown concept would require hundreds of new combinations.

Although the Bolus concept of the genus was used in Europe and in South Africa, it was not of universal acceptance. Indeed in South Africa, both editions (1926, 1951) of *The Genera of South African Flowering Plants* by Phillips use Brown's concept of *Mesembryanthemum*. In Australia, Blake (1969) also uses the genus *Mesembryanthemum* according to the concept of Brown and lists *Gasoul* Adanson as the genus for those species known to Bolus as *Mesembryanthemum*. In California, the Brown concept is implied by the utilisation of the genus *Gasoul* for those species of *Mesembryanthemum* under the Bolus idea (Munz, 1974). And in *Index Nominum Genericorum* (Farr et al., 1979), *M. umbellatum* is listed as the lectotype of the genus *Mesembryanthemum*. Even in *The genera of the Mesembryanthemaceae* (1971), Herre lists in error *M. crystallinum* as the type of *Mesembryanthemum* (this is the type of *Cryophytum* N.E. Br., the equivalent of *Mesembryanthemum* of Bolus).

In regard to the hundreds of new combinations, the Brown concept of *Mesembryanthemum* corresponds with the present-day genus *Ruschia* Schwantes; and of the over 350 *Ruschia* species currently accepted, almost 200 have combinations in *Mesembryanthemum*. Of the remaining species without *Mesembryanthemum* combinations, many if not most would likely be reduced to synonymy in a modern revision of the group (none of which exists though there is one started). The close to 50 species of *Mesembryan-*

themum sensu L. Bolus would not add to the "combinationes novae" avalanche since all but four have combinations in *Cryophytum* N.E. Br., the genus which coincides with the Bolus *Mesembryanthemum*.

It appears the conserved concept of *Mesembryanthemum* L. emend. L. Bolus may not have had as convincing evidence for its acceptance as previously thought. The idea of *nomina conservenda* should not be hastily decided but a thorough and complete investigation should be conducted before a conclusion is rendered. In accordance with the *International Code of Botanical Nomenclature* (Articles 14 and 15), we must accept *Mesembryanthemum* L. emend. L. Bolus as the accepted definition with *M. nodiflorum* as the lectotype.

TAXONOMIC DISCUSSION

Even using the accepted definition of *Mesembryanthemum* provided by Bolus (1939), there is still some taxonomic controversy as to which (or all) of several closely allied genera should be included in *Mesembryanthemum*. The genus *Cryophytum* N.E.Br. is certainly a synonym of the genus but other genera like *Callistigma* Dinter et Schwantes, *Derenbergiella* Schwantes, *Eurystigma* L. Bolus, *Halenbergia* Dinter, *Hydrodea* N.E.Br., *Opophytum* N.E.Br., in fact all of the subtribe Mesembryantheminae Ihl. Schwant. & Straka except *Synaptophyllum* N.E. Br., might easily be included under *Mesembryanthemum* with only a slight modification of the Bolus definition. All of these genera have peculiarities which might warrant their maintenance as being distinct from *Mesembryanthemum*.

Although this present work in no way pretends to have made a thorough study of these plants, we are of the opinion that all of the above listed genera should be treated as belonging in *Mesembryanthemum* as stated by Friedrich, 1968. Furthermore within *Mesembryanthemum*, the group of species previously placed in *Opophytum* should be given subgeneric or sectional status. However, the uniqueness of *Eurystigma* by nature of its broad and somewhat flattened stigmas requires further study to adequately accommodate it within a modified classification.

Based on this conclusion, *Mesembryanthemum* would therefore be distinguished by its axile (central) placentation, leaves not being connate at their base (except in the *Opophytum* group), the old leaves being deciduous, leaves opposite only at the base of the plant (or occasionally on flowering stems in *Opophytum* members), stem and leaves usually covered with papillae, stigmas filiform and capsules with valve wings present.

Mesembryanthemum setosum (L.Bol.) L.Bol. has been found to be a later homonym of *M. setosum* Moench, a species presently thought to be best placed in the genus *Delosperma*. It is difficult to understand how H.M.L. Bolus failed to notice the earlier species name since it is listed in

both *Index Kewensis* (Jackson, 1894) and *Flora Capensis* (Sonder, 1862). Regardless of how this oversight occurred, it is of necessity that specimens referred to this specific epithet be given another name.

Mesembryanthemum setosum (L.Bol.) L.Bol. (not Moench) is one of four species described simultaneously (under the genus *Cryophytum*) from specimens collected by P. Ross Frames on a trip from St. Helena Bay to Vanrhynsdorp of the western Cape in October, 1928. When *Cryophytum setosum* L.Bol. was transferred to *Mesembryanthemum* (1939), Bolus neglected to detect the previous name of Moench. As it was hoped to avoid another specific epithet under *Mesembryanthemum*, the four species, *M. rubroroseum*, *M. setosum*, *M. squamulosum* and *M. subtereticaule*, as well as *M. sedentiflorum* were closely compared morphologically.

A problem in studying *Mesembryanthemum* herbarium specimens is that the ontogenetic changes are infrequently represented. Many *Mesembryanthemum* species possess large, opposite, juvenile basal leaves whereas the mature, floral foliage is markedly smaller, alternate in arrangement and often differently shaped than the basal leaves. Consequently, studies of living specimens are the only manner in which to accurately compare these species.

With that caution to the present herbarium investigation, we have concluded that the specimens examined of the five previously listed species represent three taxa which can be separated on the basis of pubescence. We recognize *Mesembryanthemum sedentiflorum*, *M. subtereticaule* (with *M. rubroroseum* and *M. squamulosum* as synonyms) and the following species.

***Mesembryanthemum horridum* Koutnik & Lavis, nom. nov.**

Cryophytum setosum L. Bolus in Notes on Mesembrianthemum and Allied Genera 2: 53 (1929).

Mesembryanthemum setosum (L.Bol.) L. Bolus in Notes on Mesembryanthemum and Allied Genera 3: 168 (1939); non Moench, Supplementum ad Methodum Plantas 193. 1802.

Type: Between Klawer and Van Rhynsdorp, P. Ross Frames (BOL 18886) (BOL, holotype; BOL, isotypes).

Description as in Notes on Mesembrianthemum and Allied Genera 2: 53 (1929)

Mesembryanthemum horridum can be distinguished from the other two species by its possession of long (1–2 mm), acuminate papillae which are usually densely packed on the actively growing branches. *Mesembryanthemum subtereticaule* is sparsely papillose on all parts of the plant and *M. sedentiflorum* has basal leaves which are inconspicuously papillose and also young branches which have short, obtuse papillae.

DISCUSSION

As there has been no previous study of the genus *Mesembryanthemum* as delimited in this paper, an attempt was made to discover affinities among the over forty species (excluding those species previously treated as *Opophytum*) and group them into natural assemblages. From this effort, it is suggested that three groups emerge based primarily on leaf shape and reproductive strategy. Group A is distinguished by those annual species which possess terete or nearly terete leaves. Group B is intermediate between Group A and the following one by consisting primarily of annual species with flat leaves. Group C, the largest, includes biennial species with large, undulating leaves. The following lists of species indicate their assignment into one of the three groups.

Group A	Group B	Group C
<i>M. annuum</i> L.Bol.	<i>M. aitonis</i> Jacq.	<i>M. alatum</i> (L.Bol.)
<i>M. chrysium</i> L.Bol.	<i>M. breve</i> L.Bol.	L.Bol.
<i>M. dejagerae</i> (L.Bol.)	<i>M. clandestina</i> Haw.	<i>M. barklyi</i> N.E. Br.
L.Bol.	<i>M. cryocalyx</i> L.Bol.	<i>M. crystallinum</i> L.
<i>M. excavatum</i> (L.Bol.)	<i>M. inachabense</i> Engl.	<i>M. querichianum</i> Pax
L.Bol.	<i>M. lanceolatum</i> Haw.	<i>M. horridum</i> Koutnik &
<i>M. galpinii</i> (L.Bol.)	<i>M. louisae</i> L.Bol.	Lavis
L.Bol.	<i>M. paulum</i> (N.E. Br.)	<i>M. intransparens</i> L.Bol.
<i>M. inornatum</i> L.Bol.	L.Bol.	<i>M. karrooense</i> L.Bol.
<i>M. liebendalense</i> L.Bol.	<i>M. violense</i> L.Bol.	<i>M. latisepalum</i> (L.Bol.)
<i>M. linearifolium</i> L.Bol.		L.Bol.
<i>M. nodiflorum</i> L.		<i>M. macrophyllum</i> L.Bol.
<i>M. paucandrum</i> L.Bol.		<i>M. macrostigma</i> L.Bol.
<i>M. stenadrum</i> (L.Bol.)		<i>M. neilsoniae</i> (L.Bol.)
L.Bol.		L.Bol.
<i>M. subtruncatum</i> L.Bol.		<i>M. parvipapillatum</i> L.Bol.
		<i>M. pellitum</i> Friedr.
		<i>M. perlatum</i> Dtr.
		<i>M. purpureoroseum</i> L.Bol.
		<i>M. quinangulatum</i> L.Bol.
		<i>M. rhodanthum</i> L.Bol.
		<i>M. sedentiflorum</i> L.Bol.
		<i>M. subrigidum</i> L.Bol.
		<i>M. subtereticaule</i> L.Bol.

As this study was only preliminary, no formal classification is here proposed. It is hoped that this initial work will form the background necessary for a more exhaustive investigation. Much field work is required before adequate comparisons between populations, particularly in the Namaqualand region, can yield clearly defined specific delimitations. In addition, an herb-arium record consisting of a more complete representation is necessary in documenting the variability within the species.

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VEXATORELLA ROURKE, A NEW GENUS OF THE PROTEACEAE FROM SOUTHERN AFRICA

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ABSTRACT

Vexatorella, a shrubby genus of the Proteaceae subtribe Proteinae from montane fynbos and arid fynbos habitats in the winter rainfall region of the central south western Cape and Namaqualand, is newly described. Four species are recognised, *V. alpina*, *V. amoena* and *V. obtusata* (previously classified under *Leucospermum*) and a newly described species, *V. latebrosa*. *Vexatorella* is distinguished from *Leucospermum*, mainly by having terminal inflorescences; either as a terminal panicle of 2 to 6 pedunculate centrifugally opening capitula, or a solitary terminal pedunculate capitulum. (*Leucospermum* has axillary capitula). The genus is allied to *Leucospermum* but parallels *Leucadendron* in that the floral bracts become enlarged and lignified in the post-pollination phase. The flowers are white or pink, sweetly scented and believed to be insect pollinated.

UITTREKSEL

VEXATORELLA ROURKE, 'N NUWE PROTEACEAE GENUS VANAF SUIDER-AFRIKA

Vexatorella is 'n struikagtige genus van die Proteaceae subtribus Proteinae van die bergfynbos- en droë fynbos-habitatte in die winterreënvalgebied van sentraal Suidwes-Kaap en Namakwaland en word nuut beskryf. Vier spesies word erken, *V. alpina*, *V. amoena* en *V. obtusata* (voorheen geklassifiseer as *Leucospermum*) en 'n nuut beskryfde spesies, *V. latebrosa*. *Vexatorella* word onderskei van *Leucospermum* deur die terminale bloeiwyses; of as 'n terminale pluim van twee tot ses gesteelde sentrifugerende opende hofies, of 'n enkele terminale gesteelde hofie. (*Leucospermum* het okselstandige hofies). Die genus is verwant aan *Leucospermum* maar vergelykbaar met *Leucadendron* daarin dat die blomskutblare vergroot en verhout in die nabevrugting stadium. Die blomme is wit of pienk, soet-gegeurd en daar word aangeneem, deur insekte bestuif.

Key words: *Vexatorella*, new genus, Proteaceae, terminal pedunculate capitula, south western Cape.

INTRODUCTION

The most recent generic treatment of the Proteaceae in southern Africa upholds thirteen native genera (Rourke, in Dyer, 1975). While the majority appear to be well-defined and easily recognisable, difficulties have been experienced in determining the most appropriate generic placing for certain

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taxa. This was especially evident in the case of the undescribed species discussed below. Consequently, I have found it necessary to review existing generic concepts and also erect an additional genus in order to arrive at a more natural classification of the southern African Proteaceae.

In January 1954, Miss E. E. Esterhuysen collected a small vegetative shoot and a few dry inflorescences (in the post-fruiting stage) of an unknown proteaceous species from the Langeberg, near Robertson in the southern Cape. Not only was the specimen obviously of an undescribed species (here newly described as *Vexatorella latebrosa* Rourke), but it could not be assigned to any known genus in the family. Further investigations had to be postponed due to a lack of adequate material. It was not until 1981, when the author and Miss Esterhuysen succeeded in re-locating a large population at Klaasvoogds near Robertson, that a careful morphological study could be undertaken and the species' systematic position evaluated. An examination of live flowering and fruiting material confirmed the initial view that it did not fit any existing generic concept in the Proteaceae. However, a clear affinity with two other taxa, until now unsatisfactorily placed in *Leucospermum* sect. *Xericola* as *L. alpinum* and *L. obtusatum*, was apparent. Their position in *Leucospermum* has always been dubious on account of their terminal rather than axillary capitula, but it was only with the discovery of the undescribed species from Robertson, that a clear picture of generic congruence between all these taxa emerged. A new genus *Vexatorella* Rourke, is described here to accommodate them.

DISTINGUISHING CHARACTERS OF *VEXATORELLA*

(1) *Inflorescence*

A major distinction between *Leucospermum* and *Vexatorella* is the position of the inflorescence; being axillary in *Leucospermum* but terminal in *Vexatorella*. The inflorescence in *Vexatorella latebrosa*, *V. obtusata* and *V. amoena* is invariably a single terminal pedunculate capitulum, but in *V. alpina* the inflorescence is frequently compound in the form of a terminal panicle of up to six pedunculate capitula, opening in basipetal (centrifugal) sequence (Fig. 1).

(2) *Leaves*

The leaves of *Leucospermum* are toothed at the apex when mature or if not when mature, then at least toothed in the juvenile stages. *Vexatorella* consistently produces linear-spathulate or obovate to spathulate-elliptic leaves with a single apical callus but no toothing, even in the juvenile stages.

(3) *Perianth*

In *Leucospermum* the three adaxial perianth segments are fused while



FIG. 1.

Diagrammatic representation of inflorescence structure in *Leucospermum* (A) which has pedunculate axillary capitula and *Vexatorella* (B & C) which have terminal pedunculate capitula, either compound as in *V. alpina* (B) or solitary as in *V. latebrosa*, *V. amoena* and *V. obtusata* (C). Peduncular tissue is stippled and the meristems initiating continued growth are marked with an arrow.

the abaxial perianth segment separates and remains free, except in the tube region. The perianth in *Vexatorella* opens symmetrically at anthesis with four free perianth segments separating equally, only being fused in the tube region.

(4) *Floral bracts*

Each floral bract subtending a pollinated flower in *Vexatorella* enlarges conspicuously and becomes lignified as the fruit matures within the capitulum. However, *Leucospermum* shows no such tendency, the floral bracts remaining soft and inconspicuous after the fruits have been released.

(5) Fruits

The fruits in *Leucospermum* and *Vexatorella* are small nut-like achenes, minutely puberulous to glabrous, with an adaxial suture. Fruits in *Vexatorella* are prominently beaked apically due to the persistent remnants of the style base but are tapered, obtuse and wrinkled basally. *Vexatorella* fruits are morphologically very similar to *Paranomus* fruits. By contrast, the fruits of *Leucospermum* lack an apical beak and are broadly emarginate at the base.

(6) Pollen

Palynological studies on southern African genera of the Proteaceae subtribe Proteinae (sensu Johnson & Briggs, 1975), indicate that pollen grains tend to be rather uniform, showing little significant generic differentiation (Erdtman, 1966; van Zinderen Bakker, 1953). Nevertheless, a routine S.E.M. investigation of pollen from all four *Vexatorella* species was undertaken. This revealed that the pollen is similar in morphology and sculpturing to other southern African genera of the subtribe, confirming the above views. The pollen grains are of medium size, $\pm 30\text{--}35$ microns in diameter, with the sculpturing a smoothish, irregularly knotted reticulum (Fig. 2). No taxonomically significant characters at generic level are observable in the pollen of the four species assigned to *Vexatorella*.

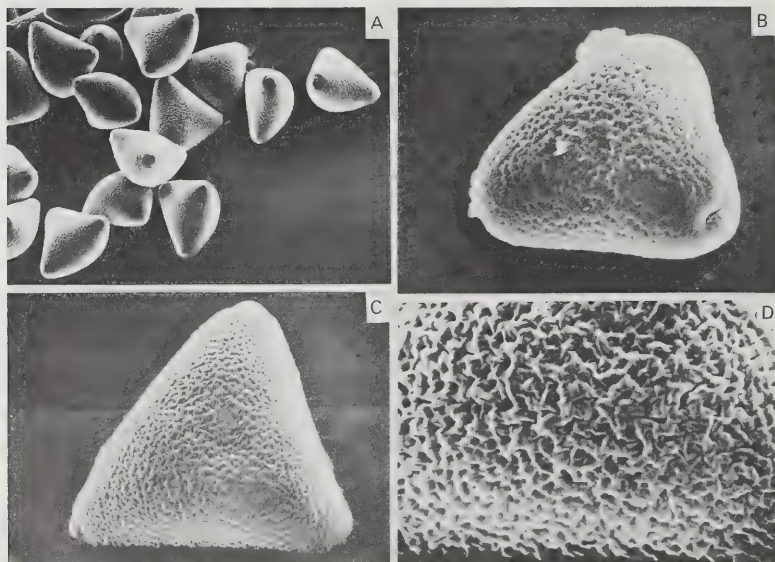


FIG. 2.

S.E.M. studies of *Vexatorella* pollen grains. (A) *V. latebrosa* (Rourke 1780). Horizontal field width 150 microns; (B) *V. alpina* (Rourke 1800). Horizontal field width 55 microns; (C) *V. latebrosa* (Rourke 1780). Horizontal field width 50 microns; (D) *V. latebrosa* (Rourke 1780). Horizontal field width 21 microns.

POLLINATION

Brief diurnal field observations on all four species have failed to yield any data on possible pollinators. However, several characteristics suggest insect pollination as being most probable. These are: the sweet very distinctive perfume peculiar to this genus which is emitted by the flowers on opening; the pale cream or pink coloured flowers; the absence of any style elongation at anthesis, as is typical of ornithophilous Proteaceae; and the rather small nectar volumes in each flower.

In particular, the pale flower colour in some species and the sweet perfume suggest nocturnal visits by moths as a likelihood.

RELATIONSHIPS AND DISTRIBUTION

As previously suggested (Rourke, 1983), the genera of the Proteaceae subtribe Proteinae can be arranged in a number of subsidiary groupings; *Leucospermum*, *Diastella*, *Mimetes* and *Orothamnus*, constituting one such clustering. Although *Vexatorella* is clearly associated with these genera and appears to be closely allied to *Leucospermum*, some of its characters (e.g. small-flowered terminal capitula with floral bracts becoming lignified in the post-pollination phase) suggest an affinity with *Leucadendron* (subtribe Aulacinae). This latter modification may foreshadow the development of the woody female cone in the dioecious *Leucadendron*. Within *Vexatorella* the most obvious evolutionary trends concern the inflorescence. *Vexatorella alpina*, in which the inflorescence is either a terminal panicle of up to six pedunculate capitula, opening in centrifugal succession or a single terminal pedunculate capitulum, probably represents the least specialised primitive condition; while *V. latebrosa*, *V. amoena* and *V. obtusata*, producing consistently solitary terminal pedunculate capitula, are most likely to represent a reduced, derived condition.

With respect to its distribution, *Vexatorella* is unlike other Cape-centred genera of the Proteaceae, all of which occur adjacent to the sea coast at some point in their ranges. *Vexatorella* however, is restricted to inland mountain ranges of the central south western Cape and Namaqualand (Fig. 3), thus occupying a marginal position in arid fynbos within a region of low winter rainfall, along the ecotone between the Cape and Karoo floras. This pronounced inland shift in its distribution range, as well as its markedly ecotonal habitat requirements, suggest that *Vexatorella* is perhaps relictual and may represent a remnant of an ancestral form from which the dioecious *Leucadendron* may also have been derived.

Vexatorella Rourke, gen nov.

Frutices erecti vel decumbentes. Folia alternata, lineari-spathulata vel late elliptica, obtusa, integra, callis solitariis apicalibus. Inflorescentia ter-

minalis; plerumque capitulum pedunculatum solitarium; interdum panicula 2–6 capitulorum pedunculorum centrifuge dehiscentia. *Flores* bisexuales, actinomorphae, perianthium quadripartim; segmentis quatuor, pariter secendentes per anthesin. *Stylus* rectus, non productens. *Stigma* clavatum. *Ovarium* obovoideum vel lageniforme, uniloculatum; ovulo uno. *Squamulae hypogynae* quatuor. *Fructus* achenium ovoideum, puberulum vel glabrum, rostellatum ad apicem, obtusem et caperatum basi, sutura adaxiali.

Typus: Vexatorella alpina (Salisb. ex Knight) Rourke

Erect or sprawling shrubs. *Leaves* alternate, linear-spathulate to spathulate-elliptic, obtuse, entire with a single apical callus. *Inflorescence* terminal; usually a solitary pedunculate capitulum, occasionally a panicle of two to six centrifugally opening pedunculate capitula. *Flowers* sweetly perfumed, pink or cream, bisexual, actinomorphic, the four perianth segments separating equally at anthesis. *Style* straight, puberulous or glabrous, not elongating at anthesis. *Pollen presenter* clavate. *Ovary* obovoid to lageniform, single-chambered with a single pendulous ovule. *Hypogynous scales* 4, free, subulate. *Fruit* an ovoid, puberulous to glabrous achene, beaked apically, obtuse and wrinkled basally, with an adaxial suture.

The generic name is a compound formed from *vexator*, a trouble-maker or tormentor, one who harasses or disturbs, and the diminutive suffix *-ella*; hence "the little trouble-maker", a name which alludes to the difficulties experienced in assessing its taxonomic status.



FIG. 3.

Distribution range of the genus *Vexatorella*. The genus is confined to inland mountains in the south western Cape and Namaqualand.

DISTRIBUTION

Vexatorella comprises four species occurring in mountainous areas of the central south western Cape and Namaqualand.

KEY TO THE SPECIES OF *VEXATORELLA*

1. Leaves linear-spathulate, 1,5–6,0 mm wide.
 2. Leaves 9–45 mm long **obtusatum**
 - 2'. Leaves 50–60 mm long **latebrosa**
- 1'. Leaves obovate to spathulate-elliptic, 5–13 mm wide.
 3. Inflorescence usually a panicle of 2–6 pedunculate capitula, occasionally a solitary pedunculate capitulum; leaves 30–45 mm long; confined to Kamiesberg **alpina**
 - 3'. Inflorescence a solitary capitulum; leaves 15–30 mm long, confined to Ceres, Cold Bokkeveld and Swarttruggens mountains **amoena**

(1) *Vexatorella alpina* (Salisb. ex Knight) Rourke, comb. nov.

Protea alpina Salisb. ex Knight, Cult. Prot.: 27 (1809). Lectotype. "On the high peak of Khamiesbergh", *Niven* 47 (PH); isolectotype in herb. J. E. Smith (LINN).

Leucospermum alpinum (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. **33**: 266 (1967).

Leucospermum alpinum (Salisb. ex Knight) Rourke ssp. *alpinum*, Rourke in Jl S. Afr. Bot. Suppl. Vol. **8**: 144 (1972).

Leucadendron cartilagineum R. Br. in Trans. Linn. Soc. Lond. **10**: 67 (1810). Type: In Africa Australi without collector, in herb. Linn. Soc. et Herb. Hibbert:—not traced but clearly identifiable from description.

Protea cartilaginea (R. Br.) Poir. in Lam., Encycl. Meth. Bot. Suppl. **4**: 557 (1816).

Leucospermum cartilagineum (R. Br.) Phillips in Fl. Cap. **5**: 636 (1912).

A large, erect, spreading shrub 2–3 m in height, up to 4 m in diam. with a stout main trunk dividing near ground level into several main branches, up to 150 mm in diam. Bark smooth, grey. *Flowering branches* terete 3–4 mm in diam., initially covered with a fine crisped puberulous indumentum, soon glabrous. *Leaves* obovate to elliptic-spathulate, 30–45 mm long, 5–13 mm wide, ascending, entire, glabrous, glaucous; petioles up to 8 mm long, apex obtuse with a reddish-amber callus. *Inflorescence* either a terminal pedunculate panicle of up to 6 globose pedunculate capitula, the capitula opening in centripetal succession; or, more usually reduced to a single terminal pedunculate capitulum; peduncles 5–15 mm long, densely puberulous with one or two sterile linear bracts near base of main axis. *Capitula* 20–25 mm in diam. containing 15 to 30 flowers, lacking a surrounding involucre of sterile bracts. *Receptacle* ovoid to spherical 5–7 mm in diam. *Floral bracts* narrowly ovate



FIG. 4.

Vexatorella alpina. (1) Compound terminal inflorescence consisting of five pedunculate capitula; (2) reduced condition consisting of a solitary terminal capitulum; (3) longitudinal section through a single capitulum; (4) single flower; (5) floral bract; (6) gynoecium; (7) style apex and pollen presenter; (8) base of gynoecium showing hypogynous scales and the minutely puberulous base of the style. Drawn from Rourke 1800.

to broadly lanceolate, acute, 5–6 mm long, 2–3 mm wide at anthesis enlarging up to three times these dimensions and becoming woody in the fruiting stage. *Perianth* straight, 12–18 mm long, the four perianth segments separating equally at anthesis; outer surface puberulous with a dense crisped indumentum; tube 7–8 mm long, quadrangular, puberulous distally, glabrous proximally; claws bowed outwards above tube prior to opening; limbs narrowly elliptic to linear, cymbiform, scarcely differentiated from claws, 2–3 mm long, outer surface sparsely villous. *Style* straight, 12–18 mm long, terebate, dark carmine, usually glabrous but occasionally very sparsely puberulous proximally. *Pollen presenter* clavate, 1.5 mm long, stigmatic groove terminal. *Ovary* oblong-obovoid, 2 mm long, clearly differentiated from style, puberulous, unilocular, with a single pendulous ovule. *Hypogynous scales* linear-subulate, 1.5 mm long. *Fruit* an ovoid to obovoid, minutely puberulous achene, 6–8 mm long, 2.5–3 mm wide, prominently beaked apically, truncate and minutely pedicellate at base with an adaxial suture.

DIAGNOSTIC CHARACTERS

Vexatorella alpina is distinguished by its usually compound inflorescences, consisting of loose terminal panicles of up to six pedunculate capitula, opening in centrifugal sequence and by its obovate to elliptic-spathulate leaves, 30–45 mm long.

This is the largest species in the genus. Mature specimens develop into dense spreading shrubs 2–3 m in height and up to 4 m in diameter, with stout main trunks up to 150 mm in diameter, often branching almost at ground level. Previously, *V. alpina* and *V. amoena* were regarded as subspecies (Rourke, 1972) but in view of the significant differences in their inflorescence structure and growth habit, as well as their geographical isolation and different edaphic requirements, specific rank is here considered to be the most appropriate treatment of these taxa.

Vexatorella alpina is endemic to the Kamiesberg—the highest land surface in Namaqualand—where it occurs sporadically at elevations from 1 200 to 1 500 m between Welcome farm in the south and Leliefontein and Ezelkop at the northern extremities of its range. It is found exclusively on soil derived from Archaen granite, among large granite boulders or in open foothills often forming quite dense stands. This species is one of the larger, more prominent woody shrubs in the Kamiesberg range, even becoming locally dominant.

The inflorescences are cream-coloured and the flowers emit a strong sweetish odour on opening. Flowering takes place between September and December.



FIG. 5.

Vexatorella alpina. A flowering shoot terminated by a compound inflorescence. Note collar of bracts at base of main central peduncle. Life-size. (Rourke 1800).

SPECIMENS EXAMINED

CAPE PROVINCE—3018 (Kamiesberg): Leliefontein, Roodeberg, Ezelkop (-AC), Nov., *Drège s.n.* (M, NY, B, SAM, S, G, PRE, K, BM); Leliefontein, 4500 ft, 3/11/1830, *Drège s.n.* (P); Roodeberg, 4000–5000 ft, 10/11/1830, *Drège 2417* (P, B); Kamiesbergen, May, *Marloth 4865* (PRE); Leliefontein, Kamiesbergen, *Marloth 8758* (PRE); Ezelkop, near summit, Kamiesberg, Oct., *Adamson 1466* (CT, PRE); Kamiesberg, Feb. (in fruit), *George s.n.* (STE 19567); Beacon Hill, north of Leliefontein, Jan. (in fruit), *Pearson 6330* (BOL, SAM, K); Near Leliefontein, Sept., *Levy's 4003* (CT); Welcome, Kamiesberg, Oct., *Esterhuysen 23735* (BOL); "On the high peak of Khamiesbergh", *Niven 47* (PH, LINN, NBG); Kamiesberg range, eastern slopes 3 km north of Welcome Farm, Nov., *Rourke 1800* (NBG, PRE, K, MO).

(2) *Vexatorella amoena* (Rourke) Rourke, comb. nov. et stat nov.

Leucospermum alpinum (Salisb. ex Knight) Rourke ssp. *amoenum* Rourke in Jl S. Afr. Bot. Suppl. Vol. 8: 146 (1972). Type: Ceres district, at Katbakkies, Swarttruggens Range between Cold Bokkeveld and Ceres Karoo, *Rourke 958* (NBG, holotype; K, PRE, STE, MO, S, M, C, BOL, isotypes).

A small erect to suberect, occasionally sprawling, rather sparsely branched shrub, 1–1.5 m in height with a single main trunk 30–50 mm in diam. *Flowering branches* sparsely and minutely crisped, soon glabrous, 1.5–2.0 mm in diam. *Leaves* obovate to spatulate-elliptic, 15–30 mm long, 5–11 mm wide, entire, apex obtuse with a single thickened callus; petiolate to subpetiolate, glabrous, glaucous, coriaceous. *Inflorescence* a solitary globose, pedunculate capitulum, 15–25 mm in diam., with a small collar of lanceolate-acuminate bracts at the junction of the stem apex and base of



FIG. 6.
Distribution of *Vexatorella alpina*.

peduncle. *Capitula* containing 18–35 flowers, lacking a surrounding involucre of sterile bracts. *Receptacle* ovoid, 4–5 mm in diam. *Floral bracts* lanceolate-acuminate, 8–10 mm long, densely lanate, enlarging and becoming woody in post-pollination phase. *Perianth* 12–18 mm long, straight, outer surface densely villous, tube quadrangular, glabrous, 2–3 mm long; claws opening equally at anthesis; limbs lanceolate-cymbiform, 2 mm long, densely tomentose. *Style* terete, straight, 14–16 mm long, very sparsely puberulous, dark carmine. *Pollen presenter* clavate, 2 mm long. *Ovary* oblong, 1 mm long, puberulous. *Hypogynous scales* subulate-filiform, 2 mm long. *Fruit* an ovoid, puberulous to glabrous achene 6 mm long, 4 mm wide.

DIAGNOSTIC CHARACTERS

Vexatorella amoena is distinguished from *V. alpina* by its solitary capitula, its short (15–30 mm long), obovate to spatulate-elliptic leaves and its sparse, lax, often semi-erect growth habit.

Although previously treated as a subspecies of *V. alpina* (Rourke, 1972), consistent differences in inflorescence morphology and growth habit, as well as in leaf dimensions, suggest that specific rank is more appropriate. A sparse, open, often semi-erect growth habit to a maximum of 1.5 m in height and spread is characteristic of *V. amoena*, whereas *V. alpina* is a dense robust shrub to 3 m in height with a spread of up to 4 m.

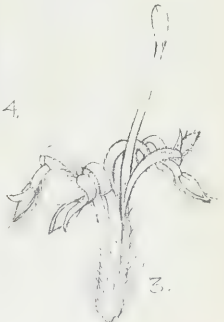
Vexatorella amoena is confined to the south eastern Cold Bokkeveld and adjacent Swartruggens mountains in the central south western Cape. It is essentially a species of mountainous terrain occurring at elevations between 1 000 and 1 500 m, in arid fynbos, exclusively on Table Mountain Sandstone formations. Flowering takes place between September and November. The sweetly scented flowers are pink to pale carmine.

SPECIMENS EXAMINED

CAPE PROVINCE—3219 (Wuppertal): Road to Ceres Karoo beyond Houdenberg, Cold Bokkeveld (-CD), Sept., *Williams 891* (NBG); Kleinveld farm, south of Bloukop, Skurweberge Range, Oct., *Rourke 1499* (NBG); Katbakkies, Swartruggens Range between Cold Bokkeveld and Ceres Karoo (-DC), Oct., *Rourke 958* (NBG, K, PRE, STE, MO, S, M, C, BOL). —3319 (Worcester): Gydo, Ceres (-AB), Nov., *Compton 18712* (NBG); Ertjesland Kloof, near Sandberg, South Cold Bokkeveld, Oct., *Esterhuysen 3449* (BOL, PRE, K); South Cold Bokkeveld, Oct., *Bond 647* (NBG); Baviaansberg (-BA), Jan., *Stokoe 4547* (BOL); Baviaansberg, Nov., *Esterhuysen 29842* (NBG); Dwarsberg, Ceres, Cold Bokkeveld, Sept., *Levyns 1942* (CT, K).

FIG. 7.

Vexatorella latebrosa. (1) Flowering shoots; (2) longitudinal section through terminal capitulum; (3) single flower; (4) perianth limb; (5) gynoeceum, showing clavate pollen presenter; (6) flower in bud, immediately before opening; (7) floral bract; (8 & 9) fruits showing abaxial view; (8) and adaxial view (9). Drawn from the type material, *Rourke 1780*.



1885

- (3) **Vexatorella latebrosa** Rourke, species nova; species erecta ramosissima, foliis linearibus-spathulatis integris, 50–60 mm longis, distinguenda.

Frutex erectus, 1–2 m altus, ramosissimus; truncus 20–35 mm in diam. *Folia* ascendentia, lineari-spathulata, 50–65 mm longa, 2–3 mm lata, obtusa, integra, supra late canaliculata, villosa ab initio, postea glabra. *Capitulum* terminale, globosum, pedunculatum, 25–30 mm in diam., floribus 40–50. *Bractae involucales* laxae 2–3 seriatæ, lanceolato-acuminatæ, 8–10 mm longæ, 2–3 mm latæ, dense villosæ. *Perianthium* 15–18 mm longum, rectum, actinomorphy, dense villosum; tubus quadrangulus, glaber, 3–4 mm longus. *Stylus* 15–18 mm longus, rectus, glaber. *Stigma* clavatum, 2 mm longum. *Ovarium* oblongo-lageniforme, 3 mm longum, puberulum.

Typus:—3320 (Montagu): Bergendal Farm, Klaasvoogds, near Robertson on S W slopes of Langeberg on a ridge between Tweevelrkbos and Middelrug (-CC), 1/9/1982, J. P. Rourke 1780 (NBG, holotype; PRE, K, BOL, S, MO, NSW, E, G, STE, isotypes).

An erect shrub 1–2 m in height with a single straight main trunk 20–35 mm in diam., usually branching at about 450 mm to form a rounded, divaricate crown up to 1 m in diam. *Flowering branches* 2–5 mm in diam., initially villous with short crisped trichomes interspersed, later glabrous. *Leaves* spreading to loosely ascending, entire, linear-spathulate, 50–65 mm long, 2–3 mm wide tapering in petiolar region, upper surface concave to broadly channelled, apex obtuse with a single reddish callus; surface densely villous to puberulous at first, glabrous when mature. *Inflorescence* a solitary terminal globose capitulum 25–30 mm in diam., sessile to shortly pedunculate, peduncle to 10 mm long; capitulum usually consisting of 40–50 flowers. *Receptacle* depressed-ovoid 6–8 mm in diam. *Involucral bracts* loosely 2–3-seriate, lanceolate-acuminate, 8–10 mm long, 2–3 mm broad at base, very densely villous. *Perianth* 15–18 mm long, straight in bud, actinomorphic; tube quadrangular, glabrous, 3–4 mm long; claws slender becoming coiled distally after anthesis, densely villous, carmine in live state; limbs very narrowly lanceolate-cymbiform, acute, 3 mm long, densely villous-hirsute. *Anthers* sessile, narrowly lanceolate-linear, connective prolonged into a distinct black apical boss. *Floral bracts* oblanceolate, acute to acuminate, tightly clasping perianth, 6–8 mm long, 2–3 mm wide, very densely lanate except at apex, enlarging and becoming woody if subtending a developing fruit. *Style* 15–18 mm long, straight, not elongating at anthesis, glabrous, with a prominent swelling at base; carmine in live state. *Pollen presenter* prominently clavate, 2 mm long, slightly annulate at junction with style, stigmatic groove terminal. *Ovary* oblong-lageniform, 3 mm long, puberulous. *Hypogynous scales* filiform-subulate, hyaline, 2 mm long, *Fruit*

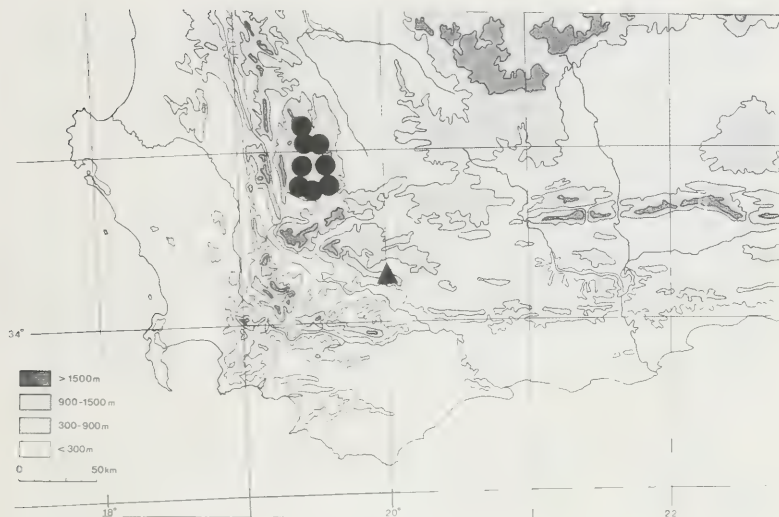


FIG. 8.

Distribution ranges of *Vexatorella amoena* (solid circles) and *V. latebrosa* (solid triangle).

an oval, minutely puberulous to glabrous achene, 8–10 mm long, 4 mm wide, beaked at stylar end, obtuse and wrinkled at base.

DIAGNOSTIC CHARACTERS

This species is readily distinguished by its linear-spathulate leaves, 50–65 mm long and conspicuously villous to puberulous at first, though later glabrescent.

Vexatorella latebrosa is a very localised endemic confined to middle slopes of the Langeberg near Klaasvoogds in the Robertson area of the south western Cape. Thus far, it is only known from a few populations dispersed over an area of several square kilometres, at elevations between 400 and 900 m. Although locally common, no records have been made outside this highly restricted distribution area. A steep south west-facing aspect is favoured on heavy reddish clay soils derived from Malmesbury shale. Most populations of this species occur in low fynbos or on the ecotone between mountain renosterbosveld and fynbos. At maturity *V. latebrosa* is a densely

branched, rounded shrub, 1–2 m in height with a single main trunk up to 35 mm in diameter. This species is not fire-resistant. Regeneration after burning is by seed.

Flowering takes place in August and September, with the fruits ripening and dehiscing during late October and early November. The flowers are pink to carmine and sweetly scented.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): South slopes of Langeberg at Klaasvoogds (-DD), 31/1/1954, *Esterhuysen 22702* (BOL).

—3320 (Montagu): South west slopes of the Langeberg, above Klaasvoogds west, on a ridge between Tweevlerkbos and Middelrug (-CC), 20/10/1981, *Rourke 1749* (NBG); Bergendal Farm, Klaasvoogds, near Robertson on south west slopes of Langeberg, 1/9/1982, *Rourke 1780* (NBG, K, PRE, BOL, STE, S, MO, NSW, G, E); Bergendal farm above Klaasvoogds, 1/11/1983 (in fruit), *Rourke 1808* (NBG, PRE, K, MO, S).

(4) *Vexatorella obtusata* (Thunb.) Rourke, comb. nov.

Protea obtusata Thunb. in Phytogr. Blätt 1: 15 (1803). Type: Cap. b. spei, Thunberg s.n., sheet No. 2946 in herb. Thunberg (holotype, UPS!)—Basionym.

An erect to suberect sprawling shrub 200 mm–1,0 m in height, 1,0–2,0 m in diam. *Flowering stems* erect or trailing, 1,0–2,0 mm in diam., thinly puberulous with fine crisped hairs, soon glabrous. *Leaves* linear-spathulate, entire, 9–45 mm long, 1,5–6,0 mm wide, apex rounded, obtuse. Leaves dull grey-glaucous, puberulous at first becoming glabrous; stiffly erect-ascending or secund. *Inflorescences* terminal, globose, 15–20 mm in diam. *Involucral receptacle* depressed globose, 30–40 mm in diam. *Involucral bracts* ovate, 60–80 mm long, 20–40 mm broad, outer surface thickly tomentose to lanate; bracts imbricate, cartilaginous, uniseriate. *Floral bracts* ovate-acute, 50–70 mm long, 25–30 mm wide, thickly lanate, tightly clasping the perianth. *Perianth* 10–15 mm long, straight, the four perianth claws becoming equally recurved at anthesis; cream or pink in fresh state. *Perianth tube* 2–3 mm long, slightly quadrangular, glabrous. *Perianth claws* filiform, the outer surface beset with a fine crisped indumentum. *Perianth limbs* lanceolate-acute, 3 mm long, outer surface very shortly villous. *Anthers* sessile, elliptic, 2,5 mm long, apical boss pointed, black. *Style* 10–13 mm long, straight, pale yellowish-green at first becoming deep claret-coloured with age. *Pollen presenter* clavate-obtuse, 1,5–2,0 mm long, greenish when fresh, becoming amber with age. Stigmatic pore terminal, minute. *Ovary* ovoid, 10 mm long, very clearly differentiated from style; pubescent. *Hypogynous scales* subulate, hyaline, 1 mm long. *Fruit* an ovoid, puberulous to glabrous achene, 5–6 mm long, 4 mm wide.

DIAGNOSTIC CHARACTERS

The entire linear-spathulate leaves, 9–45 mm long, attenuate to petiolate at the base, distinguish *V. obtusata* from all other species in the genus.

KEY TO THE SUBSPECIES

Stems decumbent or trailing, leaves secund, 10–25 mm long. ssp. ***obtusata***
 Stems erect, leaves loosely ascending imbricate, 22–45 mm long. ssp. ***albomontana***

(a) subsp. ***obtusata***

Protea obtusata Thunb. in Phytogr. Blätt. 1: 15 (1803). Type: Cap. b. spei, *Thunberg s.n.*, sheet no. 2946 in herb. Thunberg (holotype, UPS).

Protea obtusa Thunb. in Nova Acta Acad. Sci. Imp. Petrop. Hist. Acad. 15: 461, tab. 3 fig. 2 (1806). Type: As for *P. obtusata*.

Leucadendron ? *obtusatum* (Thunb.) Meisn. in DC., Prodr. 14: 227 (1856).

Leucospermum obtusatum (Thunb.) Phillips in Fl. Cap. 5: 637 (1912); Rourke in Jl S. Afr. Bot. Suppl. Vol. 8: 146 (1972).

A sprawling decumbent shrub with stems trailing along the ground; forming dense mats, 1.0–2.0 m in diam. *Leaves* secund to subsecund, linear-spathulate, 10–25 mm long 0.5–4.5 mm wide.

Vexatorella obtusata subsp. *obtusata* occurs mainly in the Waboomsberg and Koo mountains in the Montagu district at the southern end of its range, extending westwards to Keeromsberg (Worcester), with northerly outliers on Matroosberg and at Bokkeriver near Ceres.

This prostrate subspecies occurs in arid fynbos on soils derived from Table Mountain Sandstone, generally at elevations between 300 and 1 800 m. Mature specimens develop into dense spreading mats up to 200 mm in height and 2 m in diameter, with numerous branches radiating from a stout main trunk and trailing over the ground. The sweetly scented cream or pink inflorescences are produced from September to December, usually on young shoots at the perimeter of the shrub.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): Matroosberg (-BC), *K. L. Davidson* 15 (K), and 37 (SAM); Bokkeriver-Farms (-BD), Nov., *Horrocks* 127 (NBG); Keeromsberg, S W side (-DA), Nov., *Esterhuysen* 9286 (BOL); Keeromsberg, Koo Valley side (-DB), *Esterhuysen* 22895 (BOL); Rooihoogete Pass, Oct., *Dahlgren & Strid* 3478 (NBG); Top of pass between Concordia and Eendracht, Oct., *Michell* 305 (PRE, CT); Concordia and Triangle, Oct., *Barnard* 683 (SAM).
 —3320 (Montagu): Waboomsberg at Brakkefontein (-CA), Oct., *Rourke* 1163 (NBG); Waboomsberg at Highlands, Oct., *Rourke* 1164 (NBG); Waboomsbergen, Eendracht (-CB), Sept., *Compton* 18388 (NBG, BOL); Eendracht, Sept., *Lewis* 1645 (SAM).



FIG. 9.

Distribution range of *Vexatorella obtusata*; subsp. *obtusata* (solid circles) and subsp. *albomontana* (solid triangle).

(b) subsp. *albomontana* (Rourke) Rourke, comb. nov. et stat. nov.

Leucospermum obtusatum (Thunb.) Phillips subsp. *albomontanum* Rourke in Jl S. Afr. Bot. Supp. Vol. 8: 148 (1972). Type: Summit of Witteberg at Bantams, Rourke 1161 (NBG, holotype; K, PRE, STE, MO, S, M, C, B, BOL, isotypes)—Basionym.

An erect to spreading shrub 0,5–1 m in height with a single main trunk. Flowering branches erect with leaves loosely ascending-imbricate. Leaves linear-spathulate, glabrous, glaucous, 22–45 mm long, 2,5–5,5 mm wide.

Vexatorella obtusata subsp. *albomontana* is distributed along the entire length of the Witteberg and adjacent Bonteberg at the western end of its range, extending eastwards to the Matjiesgoed mountains with the most easterly populations on the eastern end of the Anysberg, near Ladismith.

Throughout its range this subspecies grows exclusively on Witteberg quartzite, in contrast to the typical subspecies which is confined to Table Mountain Sandstone.

It is readily distinguished by its erect, upright growth habit. *Vexatorella obtusata* subsp. *albomontana* grows in arid fynbos usually in association with other dwarf proteaceous species. The inflorescences are pink to carmine coloured, sweetly scented, and are produced between August and November.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): Eikenbosch Hoek, Bonteberg (-BD), Nov., *Esterhuysen 3700* (BOL, K, PRE).
—3320 (Montagu): Bonteberg (-AA), Nov., *Compton 9924* (NBG); Witteberg near Matjiesfontein (-BC), Nov., *J. D. Logan s.n.* No. 1155 in herb. Marloth (PRE); Witteberg near Whitehill, Nov., *L. E. Taylor 1248* (BOL); Tweedside, Witteberg Ridge, *Compton 3265* (BOL, BM, NBG, K); Summit of Witteberg at Bantams, Oct., *Rourke 1161* (NBG); Matjiesgoed mountains on the farm Klein Spreeufontein, Sept., *Vlok 439* (SAAS); East of Anysberg (-DA), Oct., *van Wyk 1000* (NBG, STE); Anysberg, eastern end of forestry track, Nov., *Vlok 763* (NBG).

ACKNOWLEDGEMENTS

I am much indebted to Miss Elsie Esterhuysen, of the Bolus Herbarium, for her time and patience in helping me re-locate populations of *Vexatorella latebrosa* on the Langeberg. All specimens cited in this paper, including types, have been examined personally. In this connection, curators of various herbaria, whose material is quoted here, are gratefully thanked for making this material available to me. Sincere thanks are also due to the artists Mrs. J. Loedolff (Figs 1 & 4) and Mrs. E. Ward-Hilhorst (Fig. 7) for their invaluable contributions. I would also like to thank Mr. E. G. H. Oliver for critically reading and commenting on the manuscript.

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**PORTULACARIA ARMIANA: A NEW PORTULACARIA
(PORTULACACEAE) FROM SOUTHERN NAMIBIA**

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ABSTRACT

A new species of *Portulacaria* (Portulacaceae) from southern Namibia is described.

UITTREKSEL

PORTULACARIA ARMIANA: 'N NUWE PORTULACARIA (PORTULACACEAE) SPECIES VANAF SUIDELIKE NAMIBIË

'n Nuwe *Portulacaria*-species vanaf suidelike Namibië word beskryf.

Key words: *Portulacaria*, sp. nov., Portulacaceae, southern Namibia.

Portulacaria armiana E. J. van Jaarsveld, sp. nov.: a *Portulacaria* *afra* different, multo maioribus foliis (30–80 mm × 30–55 mm) atque erecto florentisque ramo, 3–5 m alto.

Typus: Cape Province—2817 (Tatasberg): Lower north slopes of mica-schist kopies, Dabimubrivier (-AA), 22/7/83, *van Jaarsveld and Kritzing* 7893 (NBG, holotype; PRE, WIND, K, isotypes).

Plant a rounded evergreen succulent shrub 500–700 mm tall when not in flower and 700 mm–1 m wide. *Branches* short, terete and thick, up to 35 mm in diameter, bearing conspicuous leaf scars; older branches woody, yellow-brown with bark peeling characteristically in horizontal papery flakes; flakes tough and slightly translucent; young branches softly succulent and grey-green, 9–12 mm in diam.; internodes 10–30 mm apart. *Leaves* fleshy, decussate, glaucous, obovate–ovate, 30–70 mm × 30–55 mm, base cuneate, apex rounded, margin slightly wavy; petiole short, 2–5 mm long. *Flowering branch* terminal, erect, 3–5 m long, sparingly branched, herbaceous and snapping when bent; bracts leaf-like but smaller, 30 × 14 mm, often mucronate and soon deciduous; internodes 2–10 mm apart. *Inflorescences* borne laterally from the axils, 50–100 mm long. *Flowers* in dense fascicles (up to 10): pedicels 1.5 mm; sepals 2, broadly ovate and acute, 5

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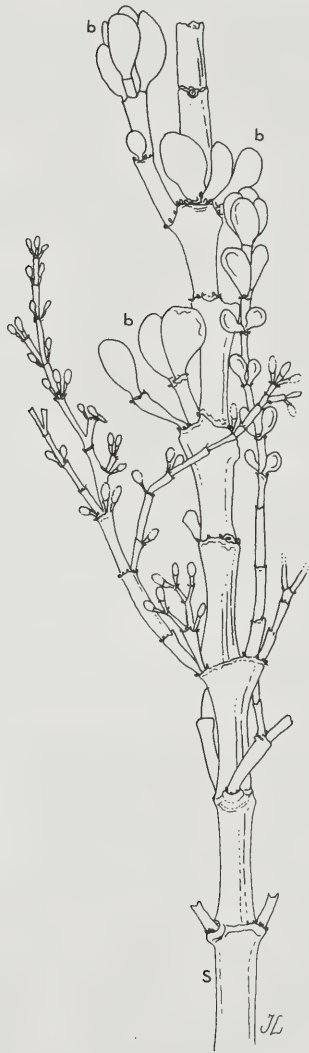


FIG. 1.
Portulacaria armiana van Jaarsveld, sp. nov. Inflorescence showing b: bracts; s: stem (life-size).

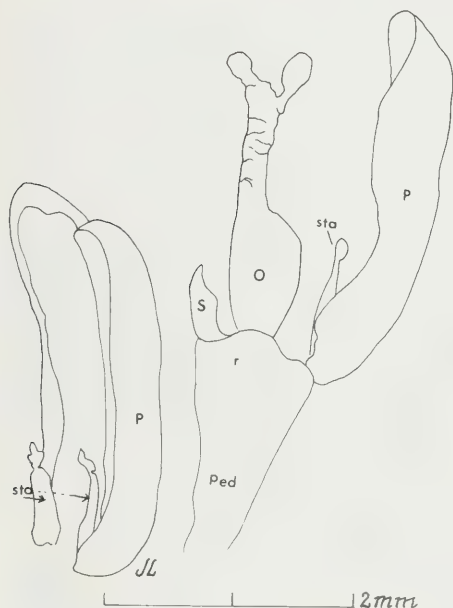


FIG. 2.

Portulacaria armiana van Jaarsveld, sp. nov. Flower showing o: ovary; p: petal; ped: pedicel; r: receptacle; s: sepal; sta: stamen.

mm long: receptacle conical, 1 mm wide; petals 5, 2.5–3 mm long, oblong and white, free to the base, hooded and obtuse at the apex; stamens 0.75–1 mm long, often aborted, (adnate to the) petals: pistil flask-shaped, 2 mm long, style branches 3, spreading; ovary obscurely 3-angled, approximately 1 mm in length.

Flowering period: July–October.

Distribution and habitat: *Portulacaria armiana* occurs in a very dry and remote part of the lower Gariep river valley in Namaqualand Broken Veld (Acocks Veld type no. 33). It is as yet only known from a single locality approximately 3 km north of Sandberg (northern Richtersveld) but it may be more widespread in adjacent areas. This spreading succulent shrub is a conspicuous feature of the north-facing mica-schist koppies and the plants found are scattered amongst rocks. It is associated with *Euphorbia virosa*, *E. gummiphora*, *Aloe dichotoma*, *A. gariepensis*, *Pachypodium namaquanum* and



FIG. 3.

Portulacaria armiana van Jaarsveld, sp. nov. Plant in habitat north of Sandberg (southern Namib).

Ruschia schneideriana. There is a slight vegetative resemblance towards *Zygophyllum prismatocarpum* which occurs in nearby dry riverbeds. Rain-fall is very low and precipitation, which mainly occurs in winter, ranges from 25–50 mm per annum and in some years no rain may fall.

DISCUSSION

Portulacaria armiana is a very distinct and remarkable species which has up until now escaped notice due to the arid, desolate and inhospitable terrain in which it occurs. This species is not closely related to the other two South African species, *P. afra* Jacq. and *P. pygmaeum* Pill., and is easily distinguished by its much larger leaves and tall single flowering branch which reaches a height of up to 5 m. Superficially it resembles a *Cotyledon* or large

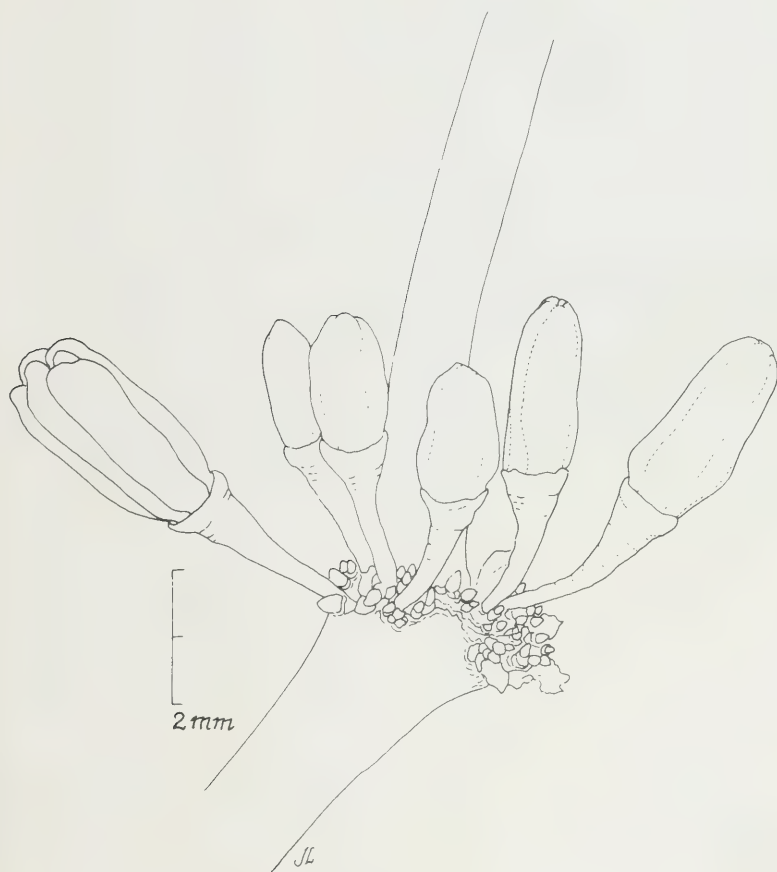


FIG. 4.

Portulacaria armiana van Jaarsveld, sp. nov. Flowering shoot showing flowers in dense fascicles.

Crassula species. The genus *Portulacaria* has an interesting distribution. *Portulacaria afra* occurs in the south east Cape and along the east coast, east of the Drakensberg escarpment to northern Transvaal. There is a large gap between the distribution of *Portulacaria afra* and the other two species from the Gariep centre of the west coast.

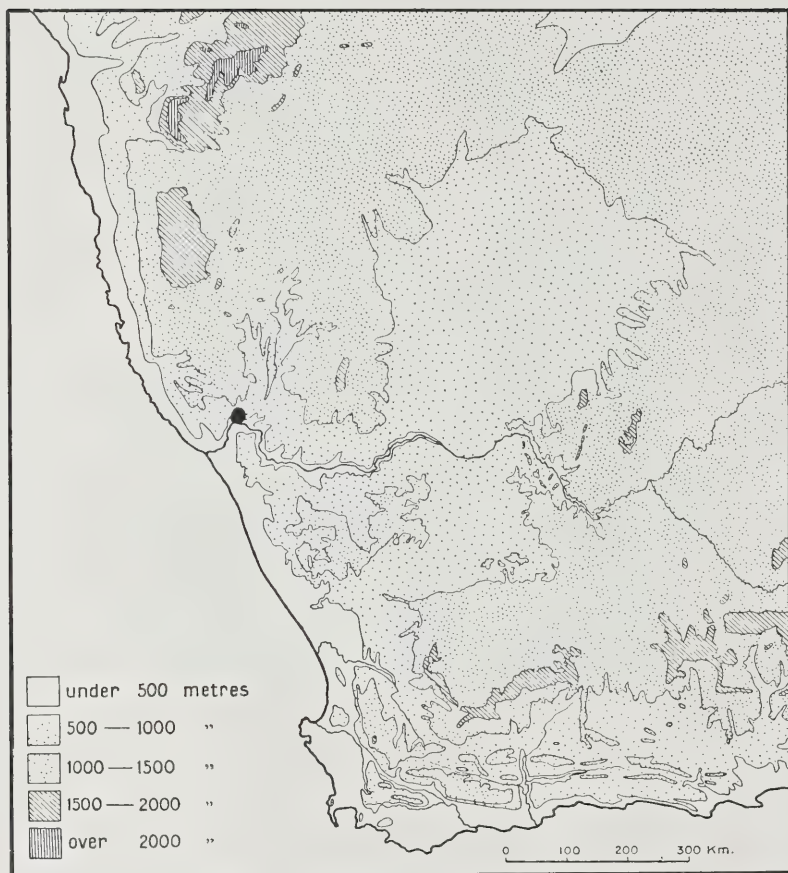


FIG. 5.
Distribution of *Portulacaria armiana* van Jaarsveld.

The new species is named after Mr. A. R. Mitchell, a botanist and a natural explorer specialising in succulents, who first came across this species. He noticed this strange "*Crassula*" with the tall flowering branch and later brought it to the attention of the author. In 1983 an expedition was arranged to investigate Mr. Mitchell's discovery. Mr Kobus Kritzing, Curator of the Hester Malan Nature Reserve at Springbok, assisted the author in the

search and the population was soon found. At first the author was puzzled as to what family this strange plant belonged but later, with the help of Dr Daryl Koutnik, of the University of Cape Town, it was found to be a species of *Portulacaria*.

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Mr. John Winter, Curator of Kirstenbosch, is thanked for allowing the author to go on this collecting trip; Mrs. Pauline Fairall and Dr. Daryl Koutnik for their valuable assistance; Mr. Norval Geldenhuys for the preparation of the Latin diagnosis; Mrs. Jeanette Loedolff for the illustrations and the author is grateful to Mr. Kobus Kritzinger for his company and assistance in successfully accomplishing this project.

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BOOK REVIEWS

ECOLOGY OF TROPICAL SAVANNAS, edited by B. J. Huntley and B. H. Walker, with pp. xi + 669 and 262 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1982. Volume 42 in "Ecological studies: analysis and synthesis". DM 118, approx. US \$47,20, R71 + GST. ISBN 3-540-11885-3.

When I was at school some masters used to insist that my essays stress only the best features of the subject under discussion and eschew defects and deleterious comparisons. While the presentation of all points *pro* to the exclusion of those *con* is integral to any argument in which the knowledgeable few participate, such unthinking advocacy produces a false impression on the uninitiated many who may never hear the other side of the argument or fail to detect the significance of what has been deliberately left unsaid. Nowhere is this more apparent than in the current debate on the sacred cow of ecologists in Africa—*Savanna*—the true nature of which this glossy, pretentious and exorbitantly expensive publication reveals little except the jejunity of those who perpetuate such an anachronism in airy disregard of plausibility or sense.

I have nothing against the overall appearance of the book; its size, pagination and durability are acceptable although the balance between illustrations and text is hopelessly lop-sided and the compressed index is in startling contrast to the extensive bibliographies of individual contributors, many of whom are outstanding examples of what Egler has described as that new sociological phenomenon, the Citation Analyst. I find them singularly unimpressive, particularly as only one—and by inference merely—condescends to cite the most substantial botanical and utilitarian classification of African vegetation in existence. Furthermore with the price of the book running at nearly twelve cents a page, both publishers and editors seem determined to turn the discerning student and research botanist into criminals. The facilities of photocopying at five cents a page will enable them to reproduce the *worth-while* content of this book for a modest outlay of thirteen rands!

As for the rest, it could be summed up in Horace's immortal line "Parturient montes, nascetur ridiculus mus", except that with the deplorable state of modern secondary education in South Africa it is doubtful if many readers have even heard of Horace, let alone translated him. The pompous pronouncements in both Introduction, Structure and Conclusion should not be taken too seriously and the editors sermonisings are as inept, tedious and contradictory as their acceptance of vernacular terms is as greatly to be deplored. In their correct usage the latter are too specialised and their proliferation here is indicative of the lack of general agreement as to what is meant by savanna in the African context. The implications for future management of Tropical African vegetation hardly bear thinking about.

What can one deduce for example from the statement, "Reference to its (i.e. Savanna's) supposed etymology, its application by early phytogeographers and its current use in the Americas, Africa and Australia have led most pedantic workers to avoid its use altogether"? As these include Engler, Schimper, Shantz, Marbut, Greenway, Polunin, Whyte, Verdcourt, Keay and a substantial body of members of A.E.T.F.A.T. whose fundamental understanding of the botanical components of African "savannas" obviously transcends that incorporated into the book under re-

view, I find such remarks tendentious and symptomatic of a doleful absence of basic knowledge of the floras.

A more serious indictment from the South African tax-payer's point of view is, of course, the colossal amount of money that has been poured into the Savanna Ecosystem Project at Nylsvley in the Transvaal. Millions of rands, which in the opinion of many of us could have been better utilised for basic ecological survey of our natural resources antecedent to the projection of firm proposals for reservation, have been spent on this "typical southern African Savanna" (page 431). Unmitigated balderdash! Readers (if in the present context any readers can be predicated) have 124 pages from which to draw their own conclusions as to the value and comparability of this research to the southern Africa landscape as a whole.

It is a curious fact that much meaningless botanical work is always done with the best intentions and that ecologists are never so trivial as when they take themselves very seriously. I hope that there will soon be an end to all of this kind for they deprive botany of much of its excitement and exhibit a want of knowledge that must be the result of years of study.

I have no doubt that this is a thoroughly well-intentioned book and presumably there will be people foolish or rich enough to buy it. But they would be advised to first have a look at a comparable volume in the "Ecosystems of the World" series edited by Boulière. It presents a more balanced coverage and a truly representative selection of data on a subject which urgently requires international integration and synthesis in a form that the rest of the botanical world will respect.

O. KERFOOT

MEDICINAL PLANTS OF NORTH AFRICA, by Loutfy Boulous, with pp. 286. Algona, Michigan: Reference Publications, Inc., 1983. US \$39.95. ISBN 0-917256-16-6.

Plants manufacture an incredible range of chemicals, many of which can affect the physiological functioning of human body tissues, producing therapeutic and/or toxic effects.

Comparatively few appear in modern official pharmacopoeias, having unquestionably proven values. Origins of the use of many of these are unknown (e.g. opium poppy, cinchona bark); others were plucked from folk medicine by acute observers (e.g. Withering and the foxglove), while very few were discovered by systematic search (e.g. the *Vinca* alkaloids).

In the foreword Dr. Ayensu states "The systematic isolation and identification of these compounds is essential if we are to help the search for new useful drugs. Unfortunately the impressive variety of plants being used in different parts of the world has not been subjected to careful study. One of the main objectives of this volume and those in the series is to assemble, in one place, basic information on the plant species used frequently in folk medicine, for the guidance of plant chemists and pharmacologists desiring to investigate the chemical constituents and to determine the efficacy of these plant resources." Well that's it; that is what this book is about. It is in effect a list of plants growing in North Africa that are known to be used medicinally, together with the ailments for which they are employed. Arrangement is in families, and vernacular names, with references, are given in abundance.

The uses of each listed plant are mentioned without qualification. Thus of the common onion we have "Bulbs are diuretic, hypoglycemic, antiscorbutic, antidia-

betic, bacteriostatic, antibiotic, intestinal disinfectant in homeopathy." While of the opium poppy we have "... analgesic, narcotic. Capsules used for intestinal disorders, chest ailments, cough, diarrhoea . . ." etc, etc. We are given no indication that onions are in truth innocuous and of no proven medicinal value, whereas opium is a valuable, powerful and dangerous drug. As another example we find "Intestinal parasites are expelled by coriander seeds." Does this unconditional statement indicate truth? or folk-lore?

369 species of vascular plants are featured, with monochrome drawings of 107 of these. The bibliography appears to be adequate, though omitting "Watt and Breyer-brandwijk"; there are indices for common names, species and ailments, and there is a glossary of medical terms. The latter includes several terms quite new to me, such as "vulnerary", "emmenagogue", "depurative", "bechic", "bourdonnement", "calefacient", "sternutatory", "cataplasme", "lenitive", "revulsive" and "albugo". "Fel-on" (how delightful) is given as equivalent to "whitlow". Etymologists might enjoy decipherment.

In summary then this book is the product of a great deal of hard work and investigation but its value and interest seem to me to be restricted to those people referred to in para 3.

W. P. U. JACKSON

HETEROSIS: REAPPRAISAL OF THEORY AND PRACTICE, edited by R. Frankel, with pp. ix + 290 and 32 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1983. Volume 6 in "Monographs on Theoretical and Applied Genetics". DM 118, approx. US \$50.90. ISBN 3-540-12125-0.

This is the sixth volume in a valuable series of monographs devoted to specific topics in genetics; all are of uniform format with hard cover and quality paper and printing, as one has come to expect from Springer.

The volume under review comprises 10 chapters, each chapter being a contribution by one or two specialists. Coverage is given to aspects of heterosis relating to: biometrical genetics; maize; barley; wheat; fodder grass; vegetable crops; tomato; onions; ornamentals; and finally, intergenomic complementation (mitochondria, chloroplasts and nucleus). The book is clearly aimed at those with theoretical or practical interests in plant breeding at the postgraduate level. The book is highly relevant to breeders in South Africa as all the crops mentioned are grown here. Each chapter on a crop also goes into breeding plans associated with the exploitation of heterosis.

The phenomenon of heterosis ("hybrid vigour" in common parlance) was recognised early in the development of genetics, the word having been coined by Shull in 1907 in connection with the superiority of heterozygotes with respect to some measurable attributes in comparison with the corresponding homozygotes. Heterosis thus results from heterozygosity but how heterozygosity leads to heterosis has yet to be explained in molecular-operational terms. In fact, it is embarrassing to note that the causal factors for heterosis at the physiological/biochemical level are today almost as obscure as they were 50 or more years ago. Nevertheless, because of its vast economic significance much progress has been made in our ability to manipulate populations to enhance heterotic expression—hybrid maize was one of the early triumphs of practical genetics. Applications of heterosis show no signs of abating, indeed they are increasing as the book shows.

Speculations as to the cause of heterosis are as old as the observations describing it. The two main theories were, briefly, the "dominance" and "overdominance" hypotheses. Jink's Chapter One (Biometrical Genetics of Heterosis) comes out in favour of dispersion and absence of genuine overdominance as the major cause, i.e. heterozygosity is not an essential prerequisite, but rather the correct gene content which can be assembled in the homozygous state, or if the alleles are completely dominant, as a heterozygote. In maize, most breeders accept the quantitative genetic approach where additive and dominance effects provide a satisfactory model for heterosis, the former being precisely those which respond to selection. However, the best inbreds are still far short of the best hybrids which suggests the persistence of some residual overdominance.

Another genetical complication could be that of epistasis between genes from parental lines interacting favourably in the hybrids; this, like dominance, should be fixable in inbreds unless impeded by linkage. A popular current view would be that dominance is the essential basis but with complications that could include some true overdominance, epistasis and so on. The matter is of practical importance because it bears on whether or not "hybrid varieties" should be bred.

Space limitations preclude detailed comment on each chapter. The final chapter opens new paths to a further understanding of heterosis by a consideration of the mitochondrial and chloroplast genes. Superior organelle functions (due to both genomic and intergenomic complementation) are thought to be essential components of heterosis, and are manifested as increased rates of DNA processing, enhanced enzyme activities and an overall faster rate of cell division.

Summing up, the text is accurate, the illustrative matter relevant and well-chosen, while the references and index are adequate. The book is well-nigh indispensable to anyone with a serious interest in theoretical and practical aspects, i.e. all plant breeders.

J. D. AGNEW

PHYSIOLOGICAL PLANT ECOLOGY: III. RESPONSES TO THE CHEMICAL AND BIOLOGICAL ENVIRONMENT, edited by O. L. Lange, P. S. Nobel, C. B. Osmond and H. Ziegler, with pp. xi + 799 and 104 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1983. Volume 12 Part C in the New Series "Encyclopedia of Plant Physiology." DM 298, approx. US \$128,50. ISBN 3-540-10907-2.

The first two parts of the four part Volume 12 of the "Encyclopedia of Plant Physiology" entitled *Physiological Plant Ecology* have received mixed receptions by various reviewers. Many of the chapters were not treated in an integrated manner and a number remained as straight plant physiology. It is a relief that Part C has achieved some degree of integration and the chapters have an ecophysiological framework, although a number of authorities are not clear what either ecophysiology or physiological plant ecology embraces. This is particularly true when one considers the theme of Volume 12 C as being responses to the chemical and biological environment. Most of the chapters have concentrated on the soil as the environment although others deal with carnivorous plants, higher plant host/parasite relationships and virus ecology.

There is very little on the aerial environment, even though a small section on lichens and air pollution is presented in the chapter on ecophysiology of lichen symbioses. Volume 12 D, however, contains a chapter on the ecophysiological effects of atmospheric pollutants. In Volume 12 C, there are a few lines in Chapter 6 on "acid rain" and chapters 6 and 7 cover aluminium toxicity and tolerances by plants. It would have been extremely interesting to have had a chapter in Volume 12 C dealing with the responses of input of nutrients from precipitation and in particular "acid rain". In those ecosystems containing oligotrophic soils, nutrients from precipitation may be a significant contribution to the pool of available soil nutrients. The pH of rain in Europe has been shown to be approximately 3 and this has resulted in marked changes to the soil environment with a drop in pH and the concomitant release of aluminium. Thus, aluminium toxicity has been a major impact of soil acidification in European forests and has caused considerable damage to trees. This has not been clearly spelt out in either Volumes 12 C or 12 D.

The aquatic environment has been considered in relation to plant ionic relations, osmoregulation and halophytes. Although the halotolerance of bacteria, micro-algae and vascular plants has been covered in depth at the physiological level, there is very little on the physiological ecology of marine algae in estuarine and marine environments. Again, this aspect is covered in Volume 12 D with chapters on nutrient cycling in freshwater and marine ecosystems, phytoplankton productivity in aquatic ecosystems and eutrophication.

Of the 24 contributors to Volume 12 C, the majority reside in the northern hemisphere with six coming from Australia. The content of each chapter therefore tends to depend upon the whims of the authors and consequently there is very little data coming from Africa. Copper-tolerant and arsenic-tolerant plant species are referred to from central and southern Africa respectively. The South African studies on *Drosera aliciae*, *Alectra vogelii* and nitrophilous plants are all referred to in Volume 12 C. However, it would have been useful to have had something on the seasonality of flowering and pollination strategies of the South African Flora in particular the Proteaceae.

In conclusion, Volume 12 C of the "Encyclopedia of Plant Physiology" is an extensive one and includes a wealth of information which would be useful to South African conditions. The final chapter is an important one dealing with interactions between plants which includes some interesting information on allelopathy. Compared with Volumes 12 A and 12 B there is a greater integration in Volume 12 C. However, after a brief glance at Volume 12 D, both Volumes 12 C and 12 D should not be consulted in isolation to one another. Finally, the 4 part series of Volume 12 dealing with Physiological Plant Ecology will appeal to undergraduates, postgraduates and research workers in botany, agriculture, ecology and plant physiology.

DEREK T. MITCHELL

A SHORT NOTE ON SEED PREDATION IN *WATSONIA PYRAMIDATA* (ANDR.) STAPF IN RELATION TO SEASON OF BURN

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ABSTRACT

Watsonia pyramidata is a common geophyte in the south western Cape, where it is well known for its spectacular mass flowering following summer and autumn fires. The results of a small field trial suggest that this synchronous flowering serves to minimise pre- and post-dispersal seed predation. The remaining seed can then germinate and the seedlings can establish themselves in the favourable post-fire environment. Seedling regeneration is absent between fires and following fires between April and October and sexual reproduction is therefore limited to the occurrence of summer and autumn burns.

'N KORT NOTA OOR DIE VREET VAN *WATSONIA PYRAMIDATA* (ANDR.) STAPF SAAD IN VERHOUDING TOT DIE BRANDTYD

Watsonia pyramidata is 'n geofiet wat volop in die Suidwes-Kaap voorkom waar dit goed-bekend is vir die aanskoulike massavertoning blomme na somer- en herfsveldbrande. Die resultate van 'n klein veld-proefneming suggereer dat die gelyktydige blom van al die plante dien om die verlies aan saad voor en na verspreiding, te verminder. Die oorblywende saad ontkiem dan en die saailinge word gevestig in die gunstige na-brandse omgewing. Saailingregenerasie is afwesig tussen brande en ook na brande tussen April en Oktober en dus is seksuele voortplanting beperk tot die voorkoms van somer-en herfsbrande.

Key words: *Watsonia pyramidata*, seed predation, fire, seedling regeneration.

INTRODUCTION

Fire is a major ecological factor controlling the development of the sclerophyll vegetation (fynbos) of the mediterranean regions of the world (Specht, 1979). The regeneration from seed of the fynbos plants appears to be almost entirely restricted to the first year following a fire, and is influenced by season of burn. *Watsonia pyramidata* (Andr.) Stapf (Iridaceae) is an example of a species with a marked response to season of burn. *W. pyramidata* is a typical mountain fynbos geophyte and is widely distributed in the mountain ranges of the south western Cape where it generally occurs in dense populations. The tough sclerophyllous leaves reach 1.0 m in

length and the inflorescences attain 1,4 m in height. It has long-lived clones made up of one to many ramets, each with its own corm (Kruger, 1978). In non-flowering years a new corm develops from the apical bud and replaces the previous one, but when the ramet flowers two new corms are formed from axillary buds as the apical bud which elongated to form the inflorescence dies. The two new corms give rise to two ramets in place of the original ramet. In normal years less than 10% of the ramets flower but when the population is subjected to a late summer or autumn burn, mass flowering is induced in the succeeding spring. The exact nature of the stimulus is uncertain but it may be related to heating of the corms during the fire, nutrients released by the fire (Bean, 1962), increased light, increased soil moisture or any combination of the above factors.

The phenomenon of mass flowering is in many ways comparable to the mast fruiting of certain tropical trees. Waller (1979) has examined the relationship between mast fruiting and life history parameters of these trees and concluded that they should have high adult survivorship and low population growth. Janzen (in Waller, 1979) concluded that high seed predation favours this form of reproduction. This mass flowering, fruiting and seed shed overwhelms the seed predators and allows sufficient seed to set and germinate and also reduces seedling mortality during establishment (Chan, 1980).

This study was designed to test the hypothesis that mass flowering and the consequent seed set and shed in *Watsonia pyramidata*, following burns in the "natural" fire season (summer to autumn) result in predator satiation and ensure an adequate seed pool for germination and population expansion. *W. pyramidata*'s population dynamics are being studied in ongoing work at Jonkershoek. This study was designed to supplement the ongoing studies and sought to answer the following questions:

- (1) What levels of seed predation are found:
 - (a) in the first season following:
 - (i) spring (poor flowering) burns;
 - (ii) late summer to autumn (mass flowering) burns;
 - (b) in populations in their second flowering season?
- (2) What types of granivores are involved?

METHODS

The sites selected for this experiment (see Fig. 1) all lie within the Jonkershoek Valley. Two broad parallel firebreaks, burnt approximately every six years, cross the valley at right angles. One half of each has a northerly aspect and the other a southerly aspect. Three study sites were placed

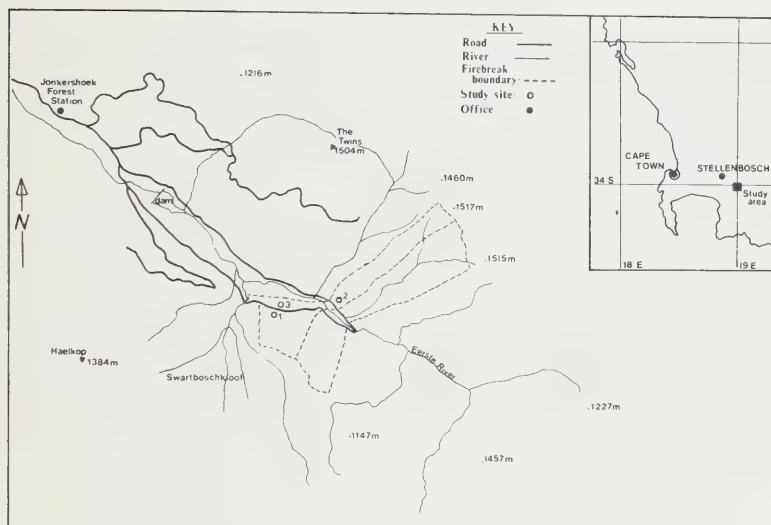


FIG. 1.

A map showing the locality of the study site, the main features of the area, the autumn burn (Site 1), the older vegetation (Site 3) and the spring burn (Site 2) study areas.

within these two breaks, but in areas burnt at different times. These are designated the autumn burnt (site 1), spring burnt (site 2) and older sites (site 3) (see Table 1). The community is dominated by restioid and graminoid components with a number of small shrubs and taller resprouting shrubs (Van Wilgen, 1980). Salient features of the sites are given in Table 1.

Seed fall was measured by trapping the falling seed and this was checked against an estimate of the seed produced by the population. Post-dispersal predation was estimated by means of selective predator exclusion. Seed release in *W. pyramidata* occurs during January and February (Kruger, 1988) and the experiment was timed to coincide with the first seed fall following the autumn burn at site one.

The seed traps were constructed of 50×12 mm wood to give an internal area of 250×250 mm. Masonite 4 mm thick was used for the base and the top was covered with 12 mm diamond mesh to exclude small mammals and birds. Small rodents such as *Mus minutoides* can penetrate this mesh but the length (6–8 mm) and the low mass (0.016 g) of *W. pyramidata* seed pre-

TABLE 1.
Details of the three study sites selected for this experiment

Details/Site	1	2	3
Aspect	North east	South east	North
Slope	10 deg.	5 deg.	6 deg.
Soil	Loam, derived from Table Mtn. Sandstone and Granite	As for site 1	As for site 1
Date of last burn	30 April 1980	21 October 1980	September 1980
Season of last burn	Autumn	Spring	Spring
Flowering season	First	First	Second

cluded any smaller mesh. Half of these traps were dipped in *Chlorpirifos* (a class B2 organo-phosphate poison) to exclude insects.

Two 50-m long parallel lines—each with trap stations at 5 m intervals—were laid out at site one on 12 January 1981. At each of the trap stations on each line a pair of traps, one poisoned and one unpoisoned, was placed and a section of soil $250 \times 250 \times 20$ mm deep was removed, and sieved for seed. This seed was counted and removed, and the soil replaced and tamped down. By this means a comparison between unhindered predation, predation primarily by insects, and no predation could be made.

At this site the population density of *W. pyramidata* and the proportion of the ramets in flower was estimated by means of a wandering quarter (Catana, 1963) survey on 16 January 1981. Sample inflorescences were collected on the same day to estimate the potential seed fall, for comparison with the seed densities estimated from the trap counts.

On 12 March 1981 at sites two and three, 10 batches of 10 seeds each were placed on the soil at 5-m intervals along a line chosen so that it passed through a *W. pyramidata* population. The number of seed at each point were counted at the subsequent surveys in order to obtain an estimate of seed predation rates on those sites relative to the autumn burnt site.

Pre-dispersal predation was estimated by counts of the numbers of whole and bored or gnawed ovaries per inflorescence. A wandering quarter sample was used to select random inflorescences at site one. The pre-dispersal predation at sites two and three was assessed by counting ovaries on the first ten available inflorescences as there were too few for a random selection.

TABLE 2.

Numbers of seed counted at site 1 at establishment and during the two subsequent visits. The seed sieved from the soil sample was counted and removed. The number of seed counted on 10 March is the total for the period 12 January to 10 March as no seed was removed on 23 January

Station	Date and purpose of the Visit					
	Establishment 12 Jan. 1981	Check Count 23 Jan. 1981		Termination 10 March 1981		
	Seed in soil	seed in traps		seed in traps		Soil
		pois.	unpois.	pois.	unpois.	
1	0	5	1	8	3	3
2	3	13	5	26	17	3
3	9	6	6	10	10	2
4	23	5	3	9	7	1
5	1	5	1	8	0	1
6	0	19	10	19	12	2
7	4	2	1	5	6	0
8	9	2	2	9	5	8
9	17	4	6	15	13	11
10	12	4	3	16	7	9
11	31	1	0	15	8	3
12	2	7	8	16	14	12
13	13	4	1	5	1	9
14	0	0	1	0	2	0
15	8	8	0	7	2	10
16	10	0	0	1	0	3
17	7	1	0	1	0	0
18	4	5	3	4	2	0
19	10	1	0	0	0	1
20	4	7	4	11	7	4
Mean	8.35	4.85	2.75	9.25	5.85	4.10

RESULTS

Watsonia pyramidata had started shedding its seed before this study was initiated on 12 January 1981. This was the source of the seed found in or on the soil on 12 January (see Table 2). Seed shed continued until early March, a period of 8 or 9 weeks. Inspection of the inflorescences showed that seed shed, like bud development and flowering, followed an acropetal pattern and probably took about two weeks per inflorescence.

At site one the wandering quarter density calculations give a density of

TABLE 3.

Numbers of ovaries per inflorescence and the percentage bored or partly eaten by insects at three sites. This count was done on 12th March 1981

Inflorescence No.	Site No. 1		Site No. 2		Site No. 3	
	No. of ovaries	% bored	No. of ovaries	% bored	No. of ovaries	% bored
1	19	0,0	26	0,0	25	32,0
2	11	9,1	14	35,7	36	36,1
3	16	0,0	20	10,0	32	78,1
4	27	3,7	27	40,7	17	52,9
5	24	12,5	24	37,5	2	50,0
6	35	0,0	31	38,7	23	60,9
7	19	0,0	18	33,3	18	0,0
8	19	5,3	9	22,2	15	0,0
9	18	5,6	12	25,0	21	57,1
10	26	0,0	18	27,8	19	21,1
Mean	21,4	3,62	19,9	27,1	20,8	38,8

2,15 (Std. Dev. = 0,11; Ashton, 1976) ramets per square metre or about 1,38 clones per square metre. Of these ramets 55,71% had flowered. Fifteen inflorescences randomly collected were used to estimate the mean number of full, undamaged seed per ramet, which was 220,40 (Std. Dev. = 92,03) or about 264 (Std. Dev. = 110) seed per m². This estimate is not significantly different from the estimate of total seed fall obtained as the sum of the mean number of seed removed from the soil on 12 January 1981 and the mean number of seed in the poisoned traps, which is 281,60 (Std. Dev. = 176,53) seed per m². If all this seed had germinated there would have been a more than 100-fold increase in the population size.

The wandering quarter survey shows that *W. pyramidata* occurs in clumps that are not randomly distributed. This, the skew distribution of seed densities in the seed traps, and the low sample size, suggested the use of a non-parametric Mann-Whitney test (Zar, 1974, p.108) rather than a t-test or multiple range tests. This test shows that the seed densities found on 10 March 1981 differ markedly (2 % level of significance) for the poisoned traps vs the soil samples, but only at the 20 % level for the poisoned vs unpoisoned and unpoisoned vs soil sample densities.

By 12 March 1981 seed shed was complete at site one, but there was abundant seed still lying on the soil surface. By 24 April 1981—when the last count was made at site three—there was very little seed still evident on the

TABLE 4

Seed predation at the spring burnt sites in the first and second flowering season. Ten seeds were placed at each station on 12 March 1981, and the numbers were re-counted on the dates given below

Station	Site 3: Second Season			Site 2: First Season	
	20 March	27 March	24 April	20 March	27 March
1	10	10	8	5	0
2	10	10	6	9	0
3	10	10	6	3	0
4	10	8	6	0	0
5	10	9	9	0	0
6	10	9	1	4	0
7	10	7	7	0	0
8	10	9	2	7	0
9	10	9	8	6	0
10	10	9	7	3	0
Mean	10,00	9,00	6,00	3,70	0,00

soil surface at site one. No seed was observed lying on the soil surface at either of the other two sites, probably as a result of the pre- and post-dispersal predation and the low proportion of plants in flower ($< 10\%$). Results are summarised in Tables 2 to 4.

The same test applied to the pre-dispersal predation shows that the predation was much less at site one than at sites two and three (0,5 % and 1 % level of significance respectively). The latter two sites are not statistically different in pre-dispersal predation rates although the rates of "post-dispersal" predation are significantly different (0,1 % level of significance).

DISCUSSIONS AND CONCLUSIONS

The satiation hypothesis rests primarily on the assumption that the large fruit and seed crop produced periodically provides sufficient excess to allow the establishment of seedlings despite a possible increase in pre- and post-dispersal predation. If therefore sampling of vegetation with mass and sparsely flowering *W. pyramidata* showed that seedling establishment was equally likely in both cases then the hypothesis would be refuted.

The pre-dispersal predation figures support the satiation hypothesis and suggest that the higher density of the flowers out-weighed the extra attraction of the abundant food source for the primary consumer, a small snout beetle (Circulionidae). Site two has about the same average density of *W.*

pyramidata while site three has a much lower density. After the spring burn on site two less than 10 % of the clones flowered and if this is converted to an area basis it gives about 1,6 bored ovaries per m² on this site against 0,9 for site one.

The post-dispersal predation rates are more difficult to interpret. The differential predator exclosures were successful and worked as expected. The results suggest that insects are more important than birds and rodents in *W. pyramidata* seed predation. This may be because the low aerial plant cover in the young vegetation discouraged rodents (Bond *et al.*, 1980), although this scarcely affects nocturnal species (J. Breytenbach, W. Bond, pers. comms.).

This factor may also account for the lower seed predation rates at site three in relation to the spring burn site two as the vegetation on site three is more open. A further factor that could reduce rodent populations is the fact that on all these sites the post-fire seed store would have been depleted (J. Breytenbach, pers. comm.). At the end of the season the visible seed had apparently been removed on all sites. A count of seedling densities in November 1982 gave a seedling density of two to three per square metre on site one, but none could be found at sites two or three. The seedling density could be higher as they are difficult to spot except in open areas. Kruger (1978) found initial seedling densities as high as 75 times the parent population, but the seed to seedling ratio in his study (ca. 4, 5) is about the same as that on site one (ca. 5,0).

The hypothesis that this mass flowering response is a means of establishing seedlings in an environment with the maximum availability of suitable sites for its particular regeneration niche can be seen as an extension of the primary hypothesis. Seedling establishment is an extremely vulnerable stage in the life-cycle of a plant (Harper, 1977) and the requirements of the regeneration niche (Grubb, 1977) are critical at this stage. The primary hypothesis states that this mass flowering is a means of producing a maximum seed crop to fill the available regeneration niches and thus meets the requirements of this second hypothesis. Neither hypothesis however, suggests why this response is linked to season of burn because seed regeneration seems to be primarily restricted to the wet season (le Maitre, in prep.; Wicht, 1948) and because *W. pyramidata*'s flowering season is not altered by season of burn. This means that the availability of regeneration niches would probably be the same regardless of season of burn, and that a mass flowering response should give much the same population increase regardless of season of burn. The response to burning during the "natural" fire season must therefore be linked to the phenology of *W. pyramidata*, but this postulate could not be tested during this experiment.

One major question which should be tackled in any future studies that

are designed to substantiate the satiation hypothesis, and the results of this experiment, is the problem of the fate of the majority of the seed. The mass flowering response does enable the species to establish large seedling populations in years following burns in the "natural" fire season. This is important for the long term conservation of the species because it enables the species to reproduce sexually and maintain its genetic diversity as well as maximising its vegetative reproduction.

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OBSERVATIONS OF A MECHANISM BY WHICH SELF-POLLINATION MAY OCCUR IN *EULOPHIA* (ORCHIDACEAE)

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ABSTRACT

Observations in live plants of a mechanism by which self-pollination may be affected in eight species of *Eulophia* from Zambia, South Central Africa, is reported on. This mechanism is illustrated in seven species and only discussed in the eighth. The illustrations were made from live specimens except for Figs 1A and 1B.

UITTREKSEL

WAARNEMINGS VAN 'N MEGANISME WAARVOLGENS SELFBESTUIWING BY *EULOPHIA* (ORCHIDACEAE) MAG VOORKOM

Waarnemings by lewende plante van 'n meganisme waarvolgens selfbestuiwing in agt *Eulophia*-species vanaf Zambia, Suid-Sentraal Afrika, word verslag oor gedoen. Die meganisme word by sewe species illustreer en slegs by die agste beskryf. Die illustrasies is van lewende eksemplare gemaak behalwe figure 1A en 1B.

Key words: *Eulophia*, Orchidaceae, Zambia, self-pollination.

INTRODUCTION

Very little work has been done on the pollination biology and breeding systems of tropical African orchids. Williamson has commented on and illustrated autogamy in various genera (1977, 1979, 1980). Gassner (1982) has published a short account of self-pollination in *Disa stolzii* Schltr. = *Disa erubescens* Rendle subsp. *carsonii* (N. E. Br.) Linder. Cribb and Gasson (1982) recorded unusual asexual (vegetative) reproduction in *Cynorkis uncata* (Rolfe) Kraenzl. from East Africa.

Charles Darwin (1904) repeated an observation made by Dr Crüger on three plants from Trinidad "it is easily seen that the pollen-masses have been acted on by the stigmatic fluid, and that the pollen tubes descend from the pollen-masses in situ down into the ovarian canal." This observation made in 1864 is almost identical to the observations recorded in this paper on autogamy in African *Eulophia* species.

During work on the orchids of Zambia over two decades numerous field observations on self-pollination were made on several different genera. Observations made on *Eulophia* species are reported on in this paper.

OBSERVATIONS

At a certain level of maturity of the flowers, the pollinia become active and outgrowths begin to appear from the lower border of the pollinia. These growths take on various forms. In *E. farcta* Williamson, the growths are cylindrical and grow towards the stigma completely covering the viscidium and rostellum until the stigma is reached (Fig. 1.1A). The growths in *E. saxicola* Cribb & Williamson are large and spherical lifting the anther cap and becoming fused to the cap base (Fig. 1.2A).

In *E. nyassae* Rendle, the outgrowths tend to be rather narrow and were seen to penetrate the rostellum on their way to the stigma. Fig. 1.3 shows part of the rostellum dissected away where the outgrowth was removed illustrating the growth penetration. *Eulophia ecalcarata* Williamson (Fig. 1.4) displayed very large outgrowths which tended to bypass the viscidium and then curve backwards over the rostellum to contact the stigma. The pollinia plus the outgrowths are shown in Fig. 1. 4C.

Eulophia katangensis (De Wild) De Wild (Fig. 1.5) was observed to have the same outgrowth pattern as in *E. farcta* but the viscidium was obsolete in many flowers; however the pollinia were always joined by the caudicles (Fig. 1. 5B). *Eulophia penduliflora* Kraenzl. (Fig. 1.6) displays what might be a more efficient mechanism. The pollinia have no viscidium, stipe or caudicles and lie very low down at the base of and below the androclinium. The rostellum shelf is deeply cleft and tends to curve around the pollinia. A small amount of shiny, stigmatic tissue (Fig. 1.6A, se) projects into the base of the androclinium through the rostellum cleft. The pollinia become fused to the base of the anther cap (Fig. 1, 6 C, p) and small pollen outgrowths appear (Fig. 1, 6C, p g). The pollinia lie in virtual aposition to the stigma, thus unlike in *E. ecalcarata* the pollen growths almost immediately touch the stigmatic surface.

Eulophia acutilabra Summerh. (Fig. 1.7) displays yet again a further variation. The pollinia lie below the main portion of the androclinium, even in normal flowers (Fig. 1. 7A, p) and are attached to the viscidium by a much reduced stipe (Fig. 1. 7C). In the flowers where self-pollination appears to take place the viscidium and stipe are completely absent. As in *E. penduliflora* the pollen outgrowths have a very short distance to grow before coming into contact with the stigmatic surface (Fig. 1. 7B, p g). This phenomenon has also been observed in live plants of *E. macaulayae* Summerh. (not illustrated) where the anther cap becomes fused to the androclinium and the pollinia hypertrophy and overflow on to the stigmatic surface.

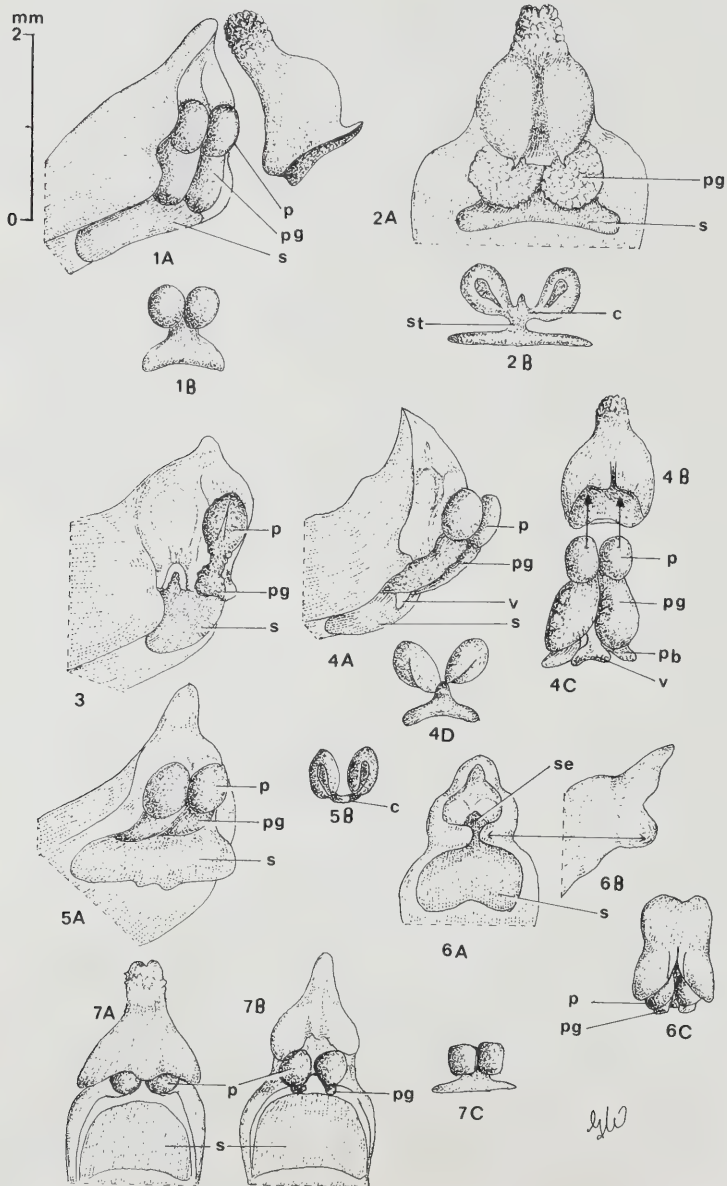
The rostellum in the species under discussion is usually a narrow shelf separating the base of the androclinium from the anterior border of the stigma. It is possible that the central portion of the rostellum contains some stigmatic tissue. Dressler (1981) suggests that in orchid self-pollination, the rostellum may function as part of the stigma. The pollinia are located loosely within the base of the anther cap. The posterior portion of the base of the cap lies between the pollinia and the androclinium and is usually split (Fig. 1. 4B and 6C). The upper third of the caps are solid and the apices are occasionally lightly papillose to verrucose.

DISCUSSION

Although capsules were seen to be present on most of the *Eulophia* species studied, except for *E. ecalcarata*, it was not noted that these capsules were actually produced from the flowers where self-pollination took place. A colony of *E. ecalcarata*, close to Lusaka, was observed periodically over a period of eight years and some of the capsules were certainly produced from flowers where the self-pollinating mechanism took place (Williamson, 1980). However, neither in this *Eulophia* or any of the other *Eulophia* species, was the fertility of the seed verified. Darwin (1905) observed that although a self-fertilized capsule of *Cattleya crispa* contained an abundance of seeds, on examination only about one per cent contained an embryo. Until proved otherwise this could well be the case in the Zambian *Eulophia* species.

During discussions with Prof. A. V. Hall of the Bolus Herbarium, the possibility of these pollen outgrowths being aberrant and abnormal was considered. This would seem unlikely due to the number of species in which autogamy was observed. Self-pollination may be an adaptation to the prevailing physical and population biological perimeters within which these species exist. Dressler (1981) stated that self-pollination has a clear advantage where a plant species is extending itself beyond the geographic range of its usual pollinator.

All the *Eulophia* species discussed occur in *Brachystegia-Julbernadia* woodland known locally as miombo (Wild & Grandvaux Barbosa, 1967). A few species occur on rock islands within the miombo [*E. saxicola* (Cribb, 1977) almost always and *E. ecalcarata* and *E. penduliflora* frequently]. Most of the species flower before the rains begin or into the early rain period, the time of maximum firing of the miombo. Due to fire, intensive cultivation and general degradation of the habitat by anthropogenic factors, all the species are rare and except for *E. ecalcarata* only occur as single plants. Some early flowering miombo Zambian species are becoming restricted to rock outcrop islands possibly because here the effects of fire and especially cultivation are minimal. Usually only one or two flowers open at a time on any one inflorescence. Due to habitat degradation, natural pollinating



agents are probably diminishing. Thus it is possible that these miombo species are more recently evolved or perhaps are still evolving towards autogamy due to a reduction in pollinators. Downing & Gibbs Russell (1981) also link lack of pollinators to anthropogenic factors. They found that orchids were virtually absent from the Umfolozi Game Reserve in Natal and suggest that this is due to the inhibition of sexual reproduction by elimination of insect pollinators as a result of extensive spraying of insecticide during anti tse-tse fly campaigns.

It is interesting to note that all the *Eulophia* species exhibiting this self-pollinating mechanism possess rather small inconspicuous flowers with two species saprophytic with greenish flowers. One of these, *E. ecalcarata*, has no spur and in *E. farcta* the vestigial spur is solid (Williamson, 1980). In both these species almost every flower produces a capsule (Williamson, 1980). Dressler (1981) notes that self-pollination is frequent in saprophytes. A further early flowering miombo *Eulophia* species, *E. williamsonii* Cribb, is evolving towards an obsolete viscidium but the pollinia are joined by the caudicles (Cribb, 1977). However, autogamy has not been observed in this species. A similar self-pollinating mechanism has also been observed in *Pteroglossaspis corymbosa* Williamson (Williamson, 1979) and in a plant of *Oeceoclades quadriloba* (Schltr.) Garay and Taylor collected by S. Marvi 1055 (BOL) from Chibi in Zimbabwe.

Self-pollination has not been observed in *Eulophia* species growing under higher rainfall conditions or where effective humidity is high, generally in wet grasslands or in dambo conditions (bogs) where there is perennial seepage. Unlike the miombo habitat which is a fire climax habitat (D. B.

FIG. 1.

1, *Eulophia farcta*; 1A, Column apex with anther cap lifted, $\frac{3}{4}$ side view; 1B, normal pollinarium. 2, *E. saxicola*; 2A, apex of column with anther cap in place, $\frac{3}{4}$ view; 2B, normal pollinarium. 3, *E. nyassae*, apex of column with anther cap removed and one pollen outgrowth dissected out, $\frac{3}{4}$ side view. 4, *E. ecalcarata*; 4A, apex of column with anther cap removed, pollinia have been lifted away from the androclonium, $\frac{3}{4}$ side view; 4B, anther cap posterior view; 4C, pollinarium plus pollen outgrowths removed from the androclonium; 4D, normal pollinarium. 5, *E. katangensis*; 5A, apex of column with anther cap removed; 5B, normal pollinarium with obsolete viscidium. 6, *E. penduliflora*; 6A, apex of column from $\frac{3}{4}$ below; 6B, apex of column, lateral view; 6C, anther cap from behind with fused pollinia. 7, *E. acutilabra*; 7A, column apex from $\frac{3}{4}$ below with anther cap in place; 7B, column apex from $\frac{3}{4}$ below with anther cap removed showing growth beginning from pollinia; 7C, normal pollinarium. c – caudicle; p – pollinium; pg – pollen outgrowth; s – stigma; se – stigmatic extension; st – stipe; v – viscidium; pb – pollen outgrowths bypassing the viscidium. 1, from W. D. Holmes 0181 (SRGH, K); 2, from G. Williamson and R. B. Drummond 1699 (K); 3, from G. Williamson and B. K. Simon 1793 (SRGH); 4, from G. Williamson 216 (K, SRGH); 5, from G. Williamson 1613 (SRGH); 6, from G. Williamson 1634 (SRGH); 7, from G. Williamson 1637 (SRGH).

Fanshawe and J. Moss, both formerly Dept. of Forestry, Zambia, pers. comm.) the dambo habitat contains fire tender relict plant communities but due to the perennial seepage is not easily fired. Under dambo conditions *Eulophia* species occur in large colonies and usually possess large showy flowers.

CONCLUSIONS

There appears to be an effective method of self-pollination demonstrated in eight species of *Eulophia*. Although no evidence was recorded of fertile seed-set from naturally self-fertilised flowers, it is suggested that this observed mechanism of self-pollination is probably not abnormal. This method of autogamy has been observed in 22 % of the species restricted to miombo woodland but is absent from dambo or wet grassland habitats and is possibly an adaptation to the degradation of the miombo habitat.

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**STUDIES IN THE GENERA OF THE DIOSMEAE (RUTACEAE): 15.
A REVIEW OF THE GENUS EMPLEURUM AITON**

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ABSTRACT

The two species in the genus *Empleurum* are described from fresh material with distribution maps and lists of specimens examined.

UITTREKSEL

STUDIES IN DIE GENERA VAN DIE DIOSMEAE (RUTACEAE): 15.
'N OORSIG VAN DIE GENUS EMPLEURUM AITON

Die twee spesies in die genus *Empleurum* word van vars materiaal beskryf. Verspreidingskaart word gegee asook lyste van die ondersoekte eksemplare.

Key words: *Empleurum*, *Diosmeae*, Rutaceae.

HISTORICAL BACKGROUND

In the genus *Empleurum* the first species was described under the name *Diosma unicusularis* by Linnaeus's son in the *Supplementum Plantarum* in 1781. The description was based on a fertile twig about 300 mm long, now housed in the Linnaean Herbarium in London. It was collected by Sparrmann at the Cape, most probably during his expedition towards the Fish River in the eastern Cape in 1775/76. This species had been collected previously by Auge, Thunberg and Masson. Plants were grown in the Royal Botanic Gardens at Kew, from seed received from Masson in 1774. Recognising it to be very different from *Diosma*, Solander, who is credited with writing the botanical descriptions in Aiton's *Hortus Kewensis*, placed it in a new genus which he named *Empleurum*, at the same time citing Linnaeus's *Diosma unicusularis* in the synonymy. He also gave it the superfluous specific epithet *serrulatum*. Sonder in the *Flora Capensis* (1860) upheld the name *E. serrulatum* apparently failing to notice the earlier Linnaean name *D. unicusularis* in literature. Thunberg's specimen collected in 1772 remained without mention in his herbarium until the publication of his *Pro-*

dromus Plantarum Capensum in 1794, where it was placed in the genus *Diosma* and given the epithet *ensata* which is apparently an allusion to the sword-shaped horn on the mature fruit.

J. F. Gmelin in 1796, in the *Systema Naturae*, published the name *Empleurum aitoni*, citing the reference to the generic description on page 513 in the *Hortus Kewensis* but omitting any reference to the specific description on page 340 where the epithet *serrulatum* had already been published. Ecklon and Zeyher, who attempted to distinguish between large and small leaf forms of *E. unicasulare*, made the combination *Empleurum ensatum* in order to designate the large leaf form and allowed *Empleurum serrulatum* to represent the small leaf form in their *Enumeratio Plantarum* published in 1835.

Seed received from the Cape Colony in 1910 by the United States Department of Agriculture prompted H. C. Skeels to make the new combination *Empleurum unicasularis* (L.f.) Skeels, published in 1911, using a feminine rather than a neuter termination to the specific epithet. The same combination using the orthographically correct neuter termination was made by G. C. Druce as *Empleurum unicasulare* (L.f.) Druce in 1917; Druce apparently being unaware of Skeels' earlier publication. It was not until 1915 that a second species in this genus was sent by P. J. Dormehl from the Grootvadersbos Forest Reserve to the Bolus Herbarium, where it was described by Miss Ruth Glover in the *Annals of the Bolus Herbarium* (1918) as *Empleurum fragrans*.

DISTRIBUTION

Populations of *E. unicasulare* are found on a north/south axis almost exactly along the nineteenth degree of longitude from the vicinity of Algeria Forest Station near Clanwilliam to the Kogelberg near Betty's Bay with an outlier on the Piquetberg, and then eastwards along the whole length of the Langeberg, the Outeniqua and the Tsitsikamma mountains, as well as on the Swartberg, Kamassie and Koega mountains to the Elandsberg and Grootwinterhoeksberg near Uitenhage. They are always found in dampish places near streams growing in acid soil lying within the region of the Cape Geological System.

Small populations of the very rare *E. fragrans* are only found in the vicinity of Helderfontein in the Grootvadersbos Forest Reserve near Heidelberg (indicated by an open circle on the distribution map Fig. 1). They are also found in dampish places but at a somewhat higher elevation than populations of *E. unicasulare*.

The genus is absent from the Cape Peninsula and Potberg.

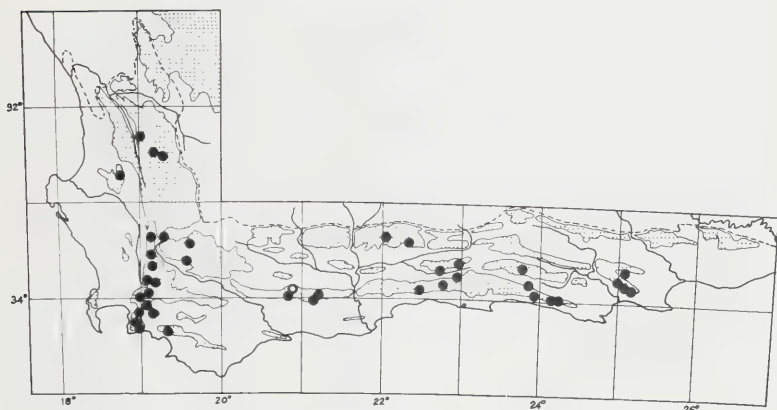


FIG. 1
Empleurum unicusulare distribution: solid dots.
Empleurum fragrans locality: open dot.

GENERIC DESCRIPTION

Empleurum Solander ex Aiton, Hortus Kewensis 3: 513 (1789); Juss., Gen. Plant.: 298 (1789); D. C. Prodr. 1: 718 (1824); Endl., Gen. Plant. 6023: 1159 (1840); Sond. in Flor. Cap. 1: 441 (1860); Benth. & Hook., Gen. Plant. 1: 291 (1862); Dyer, Gen. S. Afr. Flow. Plant. 1: 292 (1975). Type species: *E. unicusulare* (L.f.) Skeels.

Shrubs or *small trees* up to 4 m tall, erect, slender, willowy, completely glabrous, monoeciously polygamous. *Flowers* pseudo-axillary, pedicellate, often in pairs. *Calyx* 4-lobed. *Petals* absent. *Stamens* four. *Staminodes* and *disc* absent. *Ovary* superior, sessile with two ovules. *Style* delapsing. *Fruit* mostly 1-carpellate, horned.

DIAGNOSTIC CHARACTERS

The undivided gland-dotted leaves, dehiscent fruit, woody stem, four fertile stamens and exalbuminous seed, place the genus *Empleurum* in the suborder *Diosmeae* of the Rutaceae.

The 4-lobed calyx, the four stamens, the absence of petals, staminodes and disc, immediately distinguish this genus from all others in this suborder.

KEY TO THE SPECIES

- Leaves 6–8 mm long *fragrans* (2)
 Leaves 20–60 mm long *unicusulare* (1)

1. **Empleurum unicusulare** (L.f.) Skeels in U.S. Dept. Agric. Bull. 207: 54 (1911) also Druce in Rep. Bot. Exch. C1. Brit. Isles 1916 Suppl.: 621 (1917).

Diosma unicusularis Linn.f., Suppl. Plant.: 155 (1781). Type: holotype: Without locality, *Sparrmann s.n.* (LINN 270/16).

Empleurum serrulatum Soland. ex Ait., Hort. Kew. 3: 340 (1789). Nom. superf. Type: as above.

Empleurum aitonii J. F. Gmel., Linn. Syst. Nat. ed. 2: 268 (1796). Type: not known. Name apparently based on generic description only in Hort. Kew 3: 513 (1789).

Diosma ensata Thunb., Prod. Plant. Cap.: 43 (1794). Type: In monte summo Roode Sand, Sept.-Oct. 1772. *Thunberg s.n.* (UPS-THUNB 5675).

Empleurum ensatum (Thunb.) Eckl. & Zeyh., Enum. Plant.: 117 (1835). Type: as above.

Empleurum serrulatum Soland. ex Ait. var. *angustissimum* Berg in Bot. Zeit. 11: t. 12, fig. V (1853). Type: Hottentots Holland (Altid. V) supra flumen "Palmietrivier" tum prope "Hanglipp" Ecklon & Zeyher 920 (SAM, lecto.; PRE).

Empleurum serrulatum Soland. ex Ait. var. *ensatum* Berg in Bot. Zeit. 11: t. 12, fig. X, Y (1853). Type: In montibus vallis "Tulbagh" (olim "Roode Sand") ad/rivulos supra "Waterfall" Ecklon & Zeyher 919 (BOL, lecto.; PRE).

Empleurum serrulatum Soland. ex Ait. var. *intermedium* Berg in Bot. Zeit. 11: t. 12, fig. W (1853). Type: no type cited or designated in original descript. Berg in Bot. Zeit. 11: t. 12 fig. W taken as lectotype.

Icones: *Empleurum serrulatum* Soland. ex Ait., Lam. Tabl. encycl. 1: t. 86 (1791); Gaertner, de Fruct. 3: t. 211 (1805); Smith, Exot. Bot. 2: t. 63 (1805); Bartl. & Wendl. Diosm. in Beitr. Bot. 1: t. b, fig. 9 (1824); Juss. in Mem. Mus. Paris 13: t. 7, No. 21 (1825).

Empleurum ensatum (Thunb.) Eckl. & Zeyh., Engler Pflanzenfam., ed. 2, 19a: fig. 128 (1931).

Shrubs or *small trees* up to 4 m tall, erect, willowy, totally glabrous; trunk up to 110 mm diam. at base, straight, becoming branchless up to about 1.5 m from the ground; bark smooth. Branches erect, rod-like, brownish-red. *Branchlets* extremely numerous, straight, slender, pale greenish-yellow, gland-dotted, ribbed with decurrent leaf bases. *Leaves* up to 60 mm long, usually up to 3 mm wide, linear-lanceolate, spreading, alternate; apex acute with a small sharp point; margins serrate with immersed translucent gland dots; base narrowing to a petiole 1.5 mm long; abaxial surface minutely multi-gland-dotted to either side of the depressed midrib. *Inflorescence* 1,2 or 3-nate, in the axils of the leaves, apparently, terminal on vesti-

gial branchlets; *flowers* monoeciously polygamous with male flowers outnumbering the hermaphrodite flowers by about 3 to 1. *Bract* 1,5 mm long, 0,25 mm broad at base, much reduced, subulate having the margins rolled inwards, gland-dotted below, pale green, weakly ciliolate, delapsing. *Bracteoles* two, 1 mm long, 0,1 mm broad, vestigial, subulate having the margins rolled inwards, pinkish, thinly ciliolate, arising 0,5 mm up from the base of the pedicel, soon delapsing. *Pedicel* slender, gland-dotted, in the male varying in length up to 5,5 mm, but becoming twice as long or more on mature fruits. *Calyx* 4-lobed; in bud elliptical in cross-section with the end two lobes overlapping the inner two lobes to accommodate the anthers, *lobes* ovate, obtuse, gland-dotted, persisting. *Petals* and *staminodes* absent. *Filaments* four, becoming 4,7 mm long and spreading at anthesis, acicular, finally delapsing. *Anthers* four, 3,7 mm long, 1,4 mm broad, yellow, shining; *apex* emarginate, pale green or reddened with a large immersed oil gland. *Pollen* 35 μ m long, 25 μ m broad, elliptical, dry. *Disc* absent, at the base of the ovary there are several small papillae. *Stigma* at first a somewhat thumb-shaped and very smooth, subterete, organ arising to the side of the base of the horn immediately above the ovary, becoming 4 mm long and 0,6 mm diam., eventually delapsing. There is no particular receptive stigmatic area to be seen. *Style* absent. *Ovary* vestigial in male flowers; in hermaphrodite flowers superior, subcylindrical, with two ovules. *Fruit* 1-carpellate, rarely twin, 17–20 mm long including the sword-shaped horn 8–9 mm long, glabrous, shining, gland-dotted, pedicellate with the calyx persisting. *Seed* 6,2–8 mm long, 2,8–3 mm broad, black, shining; aril mostly black.

The above description was prepared from fresh material collected by the author.

SPECIMENS EXAMINED

CAPE—3218 (Clanwilliam): South slope of head south of and next to Zebra Kop, Piquetberg Division (-DB), 4000 ft., 9/11/1934, *Pillans* 7497 (BOL).

—3219 (Wupperthal): Algeria, Cedarberg, Clanwilliam Division (-AC), 26/1/1971, *Spreeth* 103 (PRE, STE), 30/6/1972. *R. H. Andrag* 91 (STE); Sederhoutkloof near Eikeboom, South Cedarberg, Clanwilliam Division, 3150 ft., 8/10/1975, *Williams* 2099 (NBG, PRE, STE); Matjiesrivier, Cedarberg, Clanwilliam Division (-AD), -/1/1944, *Wagener* 362 (NBG).

—3318 (Cape Town): Jonkershoek, Stellenbosch Division (-DD), 2100 ft., 18/4/1962, *Taylor* 3275 (PRE, STE), 6/9/1972, *Kerfoot* 6501 (PRE, STE).

—3319 (Worcester): In monte summo Roode Sand supra Waterfall prope rivulum (-AC), Sept.–Oct., 1772, *Thunberg* s.n. (UPS-THUNB 5675); Tulbagh Waterfall, Tulbagh Division, *Ecklon & Zeyher* 919 ex parte (BOL, PRE), -/3/1903, *Marloth* 2840b (PRE), 16/11/1941, *Compton* 12417 (NGB), 600 ft., 9/10/1975, *Williams* 2105 (NBG, PRE, STE); Ceres Mountains near village, Ceres Division (-AD), 600 m. -/9/1924, *Marloth* 6272 (PRE); Matroosberg near Laakenvlei, Ceres Division (-BC), 5500 ft., 20/1/1917, *Phillips* 1958 (SAM); Witte River Valley, Wellington (-CA), -/5/1934, *Esterhuysen* s.n. (BOL); Du Toitskloof, 1000–2000 ft., Oct.–Jan., *Drège*

(a) III, A, c, 9 (PRE); French Hoek Mountains, Paarl Division (-CC), 900 m, -1/1918, *Marloth 8163* (PRE); French Hoek, -1/1896, *H. Bolus s.n.* (NBG *Guthrie 4088*); La Motte Plantation, French Hoek, 4/7/1935, *Barker s.n.* (BOL 32290); French Hoek Forest Reserve, 3/9/1942, *Leighton s.n.* (BOL, PRE); Berg River Hoek, Paarl Division (-CD), 2000 ft., 3/10/1942, *Compton 13839* (NBG), 8/4/1944, *Compton 15635* (NBG); Keeromsberg, Worcester Division (-DA), 3000-4000 ft., 18/5/1944, *Esterhuysen 10168* (BOL).

—3320 (Montagu): Lemoenshoek Peak, Heidelberg Division (-DD), 4000 ft. -9/1944, *Esterhuysen 10419a* (BOL), 2500 ft., 19/10/1966, *Rourke 627* (NBG, STE); On track to Helderfontein, Grootvadersbos, Heidelberg Division, 1600 ft., 26/10/1977, *Williams 2383* (NBG, PRE).

—3321 (Ladismith): Corrente River Farm, Riversdale Division (-CC), -11/1908, *Muir 43* (PRE); Damp kloofs in Langeberg, Riversdale Division, 2000 ft., -7/1925, *Muir 3642* (PRE); Garcias Pass, Riversdale Division, -9/1929, *Muir 4468* (PRE).

—3322 (Oudtshoorn): Swartberg Pass, Prince Albert Division (-AC), *Hough s.n.* (PRE), -1/1914, *Tugwell 13991* (PRE), 4800 ft., -12/1905, *H. Bolus 11744* (PRE); Swartberg Pass south side, Oudtshoorn Division, 4000 ft., -11/1898, *Marloth 2482* (PRE), 900 m, -7/1925, *Marloth 12111* (BOL, PRE), 4000 ft., 8/5/1938, *Compton 7175* (NBG), 4200 ft., 31/5/1952, *Taylor 381* (PRE), 4500 ft., 19/6/1955, *Acoccks 18275* (PRE), 4/10/1974, *Goldblatt 2951* (PRE); Rust en Vrede (-AD), 3000 ft., -7/1925, *Dyer 83* (PRE); In Montagu Pass, George Division (-CD), 1200 ft., -10/1880, *Young s.n.* (BOL 5512); George, -8/-, *Zeyher s.n.* (SAM); George above the F.M. Tower, 2000 ft., 25/12/1971, *Williams 1616* (NBG, PRE), 23/8/1975, *Williams 2048* (NBG); Buffelsrivier, south of Kamanassieberg, George Division (-DB), 4400 ft., 4/10/1971, *Thompson 1381* (PRE, STE); In the rocky kloof about the source of the Keurbooms River (-DD), 20/3/1814, *Burchell 5078* (BOL, PRE, SAM); Manneliesberg, south slopes, Uniondale Division, 5000 ft., 18/9/1967, *Rourke 865* (NBG); Sourflats Forest, Knysna Division, 800 ft., -8/1916, *Keet s.n.* (STE 13759); Hooberg on crest of mountain, Knysna Division, 4500 ft., 17/12/1922, *Keet 1064* (PRE, STE).

—3323 (Willowmore): Avontuur, Uniondale Division (-CA), 31/7/1947, *Rose s.n.* (NBG); Kouga Mountains, peak near Smutsberg, Uniondale Division (-DB), 4000 ft., 12/11/1944, *Esterhuysen 10735* (BOL, PRE); Stormsrivier, Humansdorp Division (-DD) 280 ft., 14/11/1894, *Schlechter 5969* (BOL), 700 ft., -9/1888, *Tyson 3020* or *H.N.A.A. 986* (BOL, SAM); Die Hoek, Joubertina, Uniondale Division, -7/1941, *C. J. Esterhuysen s.n.* (BOL, NBG), 5/11/1944, *Esterhuysen 10585* (PRE), ± 2000 ft., -3/1957, *Esterhuysen 27184* (BOL).

—3324 (Steytlerville): Between Assegaaibos and Witelsbos (-CC), -4, -8/1930, *Thode A2524* (PRE); Banks of the Elands River, Zitzikamma, 500 ft., 15/9/1897, *Galpin 3878* (PRE).

—3325 (Port Elizabeth): Groendal Wilderness Reserve, Groot Plaat Farm, Uitenhage Division (-CA), 3350 ft., 1/5/1974, *Scharf 1407* (PRE); Otterford Forest Reserve, Humansdorp Division (-CC), 3/8/1974, *Rodin 1131* (BOL, PRE); Loerie Plantation, Humansdorp Division, 6/10/1934, *Dix 69* (BOL); Longmore Forestry Station, Van Stadens Mountains, Port Elizabeth Division, 450 m, 28/9/1978, *Hugo 1397* (PRE, STE); Van Stadens, Port Elizabeth Division, -5/1913, *Paterson 2441* (BOL), 31/5/1932, *Long 578* (PRE), 31/7/1932, *Long 624* (PRE).

—3418 (Simonstown): Kogelberg, Hottentots Holland Mountains, Caledon Division (-BB), -8/1924, *Stokoe 917* (BOL, PRE), -11/1924, *Stokoe s.n.* (SAM 59379), 2100 ft., 27/8/1971, *Oliver 3462* (PRE, STE); Ridge east of Kogelberg peak, 3250 ft., 21/4/1970, *Boucher 1245* (PRE, STE), 3500 ft., 27/1/1971, *Rourke 1283* (NBG), *Stokoe s.n.* (SAM 27424); Stellenbosch bei Grietjiesgat, -5/-, *Ecklon & Zeyher s.n.* (PRE 10021); In verticibus montium altis terrae "Hottentots-holland" (Altit.V) su-

pra flumen "Palmietrivier" tum prope "Hanglip", -/6/-, Ecklon & Zeyher 920 (PRE, SAM); Moordenaars-kop, Hottentotsholland Mountains, Caledon Division, -/7/1940, *Stokoe s.n.* (SAM 57799); Grabouw, Rooskraal Nature Reserve, 2225 ft., 8/5/1969, Haynes H. 33 (STE), 10/6/1937, Hubbard 439 (BOL, STE); Paardeberg, Kleinmond, Caledon Division, -/6/1950, *Stokoe s.n.* (SAM 64213); Conical hill ridge to south of Kogelberg Peak, Caledon Division (-BD), 760 m, 31/1/1973, Boucher 2086 (PRE, STE).

—3419 (Caledon): Nieuweberg Forest Station, Caledon Division (-AA), -/9/1935, *Stokoe 3192* (BOL), 2000 ft., 8/6/1973, *Oliver 4294* (PRE, STE); Houwhoek, Caledon Division, 700 ft., -/4/1982, F. & F. A. Guthrie 2234 (NBG), 1000 ft., 30/4/1896, *Schlechter 7757* (PRE); Vogelgat, streamside above Main Falls, Caledon Division (-AD), 850 ft., 18/10/1980, *Williams 3083* (NBG).

Without precise locality: Coast Districts, 1867, *H. Bolus 1682* (BOL); Auge (BM); *Sparrmann s.n.* (LINN 270/16); Port Elizabeth -/8/1927, *Brunt 249* (PRE); Ad latera montium ad Knysna and Longkoolf, -/11/-, *Mund s.n.* (SAM); Riviersonderend Mountains -/6/1949, *Stokoe 2160* (STE).

VARIATION AND BIOLOGY

There is a certain degree of variation in the size of the leaves and the height of the plants. Smaller plants with smaller leaves are found in the Hottentots Holland mountains from Nuweberg to Hangklip. A form with the broadest leaves has been found in the Elands River valley near Uitenhage at the extreme eastern end of the range. *E. serrulatum* sensu Ecklon & Zeyher refers to the form with smaller leaves and *E. ensatum* sensu Ecklon & Zeyher refers to the form with larger leaves. There is no justification for recognising these differences at specific or subspecific level as between the extremes intermediates exist.

Plants are only found growing in the vicinity of perennial streams or permanently damp places.

The flowering period extends over many months but appears to reach a peak from April to September, with fruiting being most plentiful between August and January.

The leaves are richly endowed with oil glands which apparently makes this species repulsive to insects and browsers.

The seeds are ejected by the usual catapult mechanism and having an eliasome are probably dispersed and buried by ants. Germination takes place after fires.

The leaves have a strong resinous smell when crushed but otherwise the plants smell faintly spicy, rather reminiscent of cinnamon. Common name: *false buchu*.

Of the two species in this genus, *Empleurum unicapsulare* can be distinguished by having leaves very much larger than those of its congener.

2. **Empleurum fragrans** Glover in Ann. Bol. Herb. 2. 4: 153 (1918). Holotype: Cape—3320 (Montagu): Grootvadersbos Forest Reserve, Heidelberg Division (—DD), —/9/1915, P. J. Dormehl s.n. *dedi* (BOL 13325).

Icon: *Empleurum fragrans* Glover loc.cit. Plate XA.

Shrubs 450 mm tall (plants killed in a previous fire were up to 1,7 m tall) with many stems arising from a single trunk in the grass or peat. *Branches* erect, slender, glabrous, straight; bark smooth with raised leaf scars, light brown or green. *Branchlets* very slender, somewhat lax, numerous, thinly puberulous, with raised glands, one on either side of each leaf base and others below, all turgid with oil smelling of sweet cedarwood. *Leaves* 6–7,5 mm long including the petiole 1 mm long, 2–2,3 mm broad, elliptic, acute, apiculate, glabrous, alternate, spreading-erect; abaxial surface with a few gland dots along either side of the sunken midrib; margins lumpy with swollen gland dots. *Inflorescence* solitary or sometimes twin, arising in the axils of the leaves, short-pedicellate; *flowers* monoeciously-polygamous with male flowers outnumbering the female flowers. *Bract* vestigial, 0,7 mm long, 0,2 mm broad, oblong, obtuse, ciliate, pinkish; a second bract subtends another immature floral bud. *Bracteoles* two, vestigial, 0,3 mm long, subulate, spiky ciliate, arising from a broad connate decurrent scale forming part of the pedicel. *Pedicel* about 1 mm long, glabrous. *Calyx* 4-partite, glabrous, gland-dotted; *lobes* 1–2,2 mm long, 0,6–0,7 mm broad, lanceolate acute, glabrous, gland-dotted, ciliate, persisting. *Petals* and *staminodes* absent. *Filaments* four, becoming 1,6 mm long, acicular, glabrous, pink, delapsing. *Anthers* four, 3 mm long, 1,1 mm broad, glabrous, deep red, apex with a large oil gland crowned with a sharp point. *Pollen* 22 μ m diam., subspherical. *Stigma* at first a somewhat thumb-shaped organ arising at the side of the base of the horn, smooth, red in colour, becoming about 1,4 mm long, 0,3 mm diameter, eventually delapsing. *Style* absent. *Ovary* vestigial in male flowers; in hermaphrodite flowers superior with two ovules attached at the side where the stigma projects. *Fruit* 1-carpellate, 6 mm long including a short blunt horn 2 mm long, 2,4 mm broad, glabrous, gland-dotted. *Seed* 3,5–3,9 mm long, 1,5 mm broad, black, shining; aril black, inconspicuous.

Note: one ovule does not develop at all and can be traced when the seed is ripe.

The above description was prepared from fresh material collected by the author and supplements that which was previously given by Miss Glover.

Empleurum fragrans is easily distinguished from *E. unicusulare* by having smaller leaves; by the acuminate calyx lobes and by the apiculate gland on the anther.

SPECIMENS EXAMINED

CAPE—3320 (Montagu): Grootvadersbos Forest Reserve, Heidelberg Division (-DD), -/9/1915, *P. J. Dormehl s.n. dedit* (BOL 13325); Lower S slopes of Langeberg at Strawberry Hill, Heidelberg Division, 10/9/1944, *Esterhuysen 10380* (BOL, NBG, PRE, SAM); Langeberg upper south east slopes, Heidelberg Division, 4000 ft., 19/10/1966, *Rourke 629* (NBG, PRE); On track to Helderfontein, Grootvadersbos, Heidelberg Division, 4100 ft., 26/10/1977, *Williams 2380* (NBG, PRE), 27/10/1977, *Bean 11* (BOL), 17/2/1981, *Bean 529* (BOL); The approach to Lemoenshoek Peak along the path from the road back towards the deep kloof, 1500–2000 ft., 1/1/1979, *Esterhuysen 35163* (BOL).

PHYLOGENY AND DISCUSSION

Of those genera of the Rutaceae in the suborder *Diosmeae* with apocarpous fruits, the genus *Empleurum*, with only two species, is the only one to exhibit anemophily. This condition is no doubt the result of, or has progressively resulted in the following adaptive changes: taking first *E. unicapsulare* which is widespread and relatively common:

1. The plant has a tall willow-like habit, by far the tallest of other local members of the suborder which are almost all small rigid shrubs.
2. The "pseudo-axillary" flowers are numerous and are dispersed along all branchlets in the axils of the leaves at the ends of extremely reduced branchlets.
3. Male flowers outnumber the hermaphrodite flowers and are mostly found lower down on each branchlet.
4. Hermaphrodite flowers are found towards the apex of each branchlet, the gynoecium continuing to develop after anthesis and the falling off of the spent stamens.
5. Bracts and bracteoles are virtually vestigial and soon fall off.
6. Calyx 4-lobed, apparently reduced from five.
7. Petals absent.
8. Staminodes absent.
9. Disc absent and no nectar produced to attract insects.
10. Stamens reduced to four in number.
11. Anthers about three times larger than usual with a large immersed oil gland at the apex which no doubt acts to repel nibbling insects.
12. Pollen about half the normal size, subspherical, dry, abundant.
13. Ovary one-carpellate, very rarely two-carpellate; a possible reduction from five carpels.
14. Style absent.
15. Stigma very large becoming 4 mm long, much modified, bilaterally symmetrical, possibly receptive over its whole surface at some time.

E. fragrans, except that it is a small shrubby bush much smaller in every way with flowers that have become completely axillary, possesses all of the above characters. It is a rare species perhaps having a more recent ancestry.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the assistance over many years provided by the staff at both the Bolus Herbarium at the University of Cape Town and at the Compton Herbarium, National Botanic Gardens at Kirstenbosch, where in particular he wishes to thank Miss Lovell Bosman and Dr. J. P. Rourke for help and guidance in the publication of all the papers in this series on the *Diosmeae*. I wish to thank the Botanical Research Institute for loans from their herbaria at both Pretoria and Stellenbosch and also Mrs. P. A. Bean for photographing the specimen of *Diosma unicapsulare* in the Linnaean Herbarium in London.

MOHRIA HIRSUTA, A NEW FERN SPECIES FROM THE DRAKENSBERG

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ABSTRACT

Mohria hirsuta (Filicales: Schizaeaceae), a new fern species from the Drakensberg, is described.

UITTREKSEL

Mohria hirsuta (Filicales: Schizaeaceae), 'n nuwe varing species van die Drakensberg, word beskryf.

Key words: *Mohria*, sp. nov., Filicales, Schizaeaceae, pteridophyta, Drakensberg.

Mohria hirsuta J.P.Roux, sp. nov.: filix terrestis; rhizoma prostratum, ad 3 mm diametro, brevis, sparse paleaceum, paleis linearis vel anguste lanceolatis, margine integrum, basi cordatoaffixae, albicans vel pallide castaneus, scariosus, ad 3 mm longae, ad 0.8 mm latae; frondes numerosae, erectopatentes, bipinnatipartitae; stipes teres ad 36 mm longus, pallide castaneus, sparse paleaceus, paleae basales paleis rhizomatis similes sed minores; lamina herbacea, consistentia, lineraris basi attenuatus vel oblongatus; lamina sterilis ad 145 mm longae ad 22 mm latae; lamina fertilis ad 150 mm longae ad 18 mm latae; rhachis teres, dense hirsutus; pinnae: frondes steriles, forma valde variabiles, reniformes, ovatae vel oblongae, irregulariter pinnatifidae, lobis obtusis, margines vadosae undulatis, 4-10 mm longae ad 6-7 mm latae, supra sparsis hirsutus, infra sparse hirsutus; pinnae: frondes fertiles, forma valde variabiles, anguste lineares vel oblongae, irregulariter pinnatifidae, lobis obtusis, margine remote serrulatae, ad 10 mm longae ad 7 mm latae, supra sparse glandulosae et hirsutae, infra sparse hirsutae; sporangia sparsis, submarginali in lobi apice; sporae trilateralis, rigidulis, rugulosae, ad 82 μ m diametro.

Type: South Africa, Orange Free State—2828 (Bethlehem): Tsheseng, Qwa Qwa, near cave on road to the Sentinel (-DB), *Roux 907* (NBG, holotype!; K, PRE, isotypes!). (Fig. 1 A-E & 2A-C).

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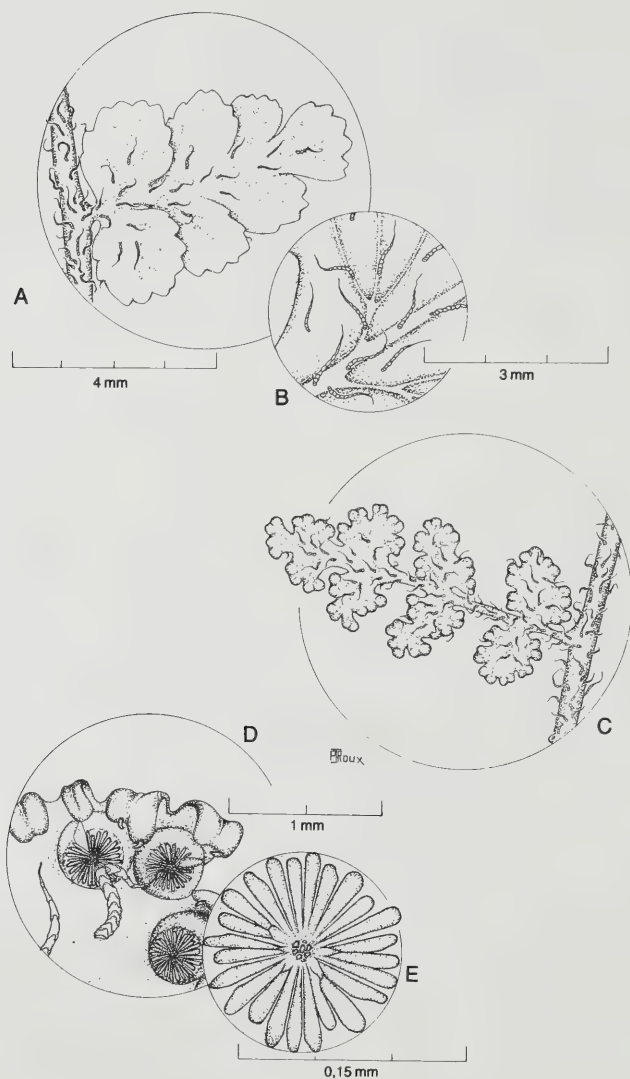


FIG. 1

Mohria hirsuta J.P.Roux, sp. nov. Roux 907. 1A Sterile mid-pinna; 1B. Magnification of sterile pinna section showing uniseriate hairs; 1C. Fertile mid-pinna; 1D. Lower surface of fertile pinna showing the large globular submarginal sporangia; 1E. Annulus cells.

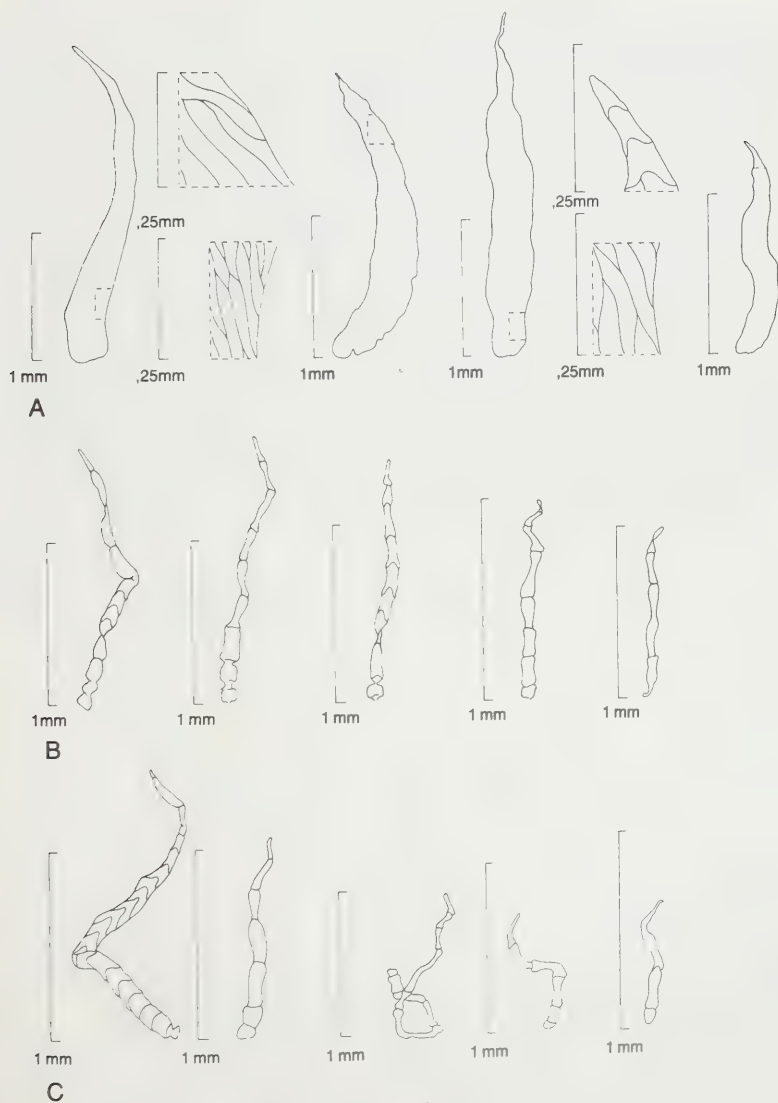


FIG. 2.

Mohria hirsuta J.P. Roux, sp. nov. Roux 907. A. Stipe base scales; B. Rachis hairs; C. Lamina hairs.

Rhizome short, prostrate, up to 3 mm diam., sparsely set with scarious, linear to narrow-lanceolate, cordate, entire, white to pale brown scales, up to 3 mm long \times 0,8 mm wide; fronds numerous, erect, crowded; stipe up to 36 mm long \times 1 mm diam., terete, pale brown, sparsely set with scarious, narrow-lanceolate, entire, pale brown scales; rachis firm, terete, erect, somewhat flexuose towards the apex, sparsely set with scales similar to those on the stipe at lamina base, absent at apex, densely hirsute to apex, hairs uniseriate, pale brown to white; lamina bipinnatifid, firmly herbaceous, oblanceolate to linear-attenuate in outline, pinnae opposite to distant, reniform in outline at base, ovate to lanceolate in outline to apex, widely spaced at base, more closely spaced towards the apex and overlapping in the sterile frond, basal pinnae up to 4 mm \times 6 mm, midpinnae up to 10 mm \times 7 mm; pinnules crowded and overlapping in sterile frond, distant when fertile, rotund to ovate-obtuse in outline, less deeply dissected to base and apex, lobed; apical margin shallowly undulate to bluntly dentate, ventral and dorsal surfaces sparsely to densely hirsute, hairs uniseriate, up to 1 mm long, white; sterile frond up to 150 mm long \times 22 mm wide; fertile frond up to 180 mm long \times 18 mm wide; sporangia borne near apices of lobes of apical pinnae only; spores pale brown, trilete, ridged, rugulose, up to 82 μ m diam.

MATERIAL EXAMINED

ORANGE FREE STATE—2828 (Bethlehem): NW slopes of The Dome (-DB), *Roux 1214* (NBG).

—2829 (Harrismith): Seheletwane, Farm Klavervlei (-CA), on Cave Sandstone rock ledges, *Roux 1068* (NBG); Summit of Seheletwane, on low rock ledges, *Roux 1069* (NBG); Seheletwane, common on summit above forest patches, *Roux 1524* (NBG).

NATAL—2829 (Harrismith): Rare on E-facing slope among Cave Sandstone boulders (-CA), *Roux 1508* (NBG).

LESOTHO—2929 (Underberg): Sehlabathebe National Park (-CC), rare in exposed seasonally moist conditions in rock crevices at the pools, *Roux 1457* (NBG).

PHYTOGEOGRAPHY AND ECOLOGY

Mohria hirsuta occurs at altitudes ranging between 2 000 m and 2 800 m in the topographically much-dissected mountainous foothills of the Natal Drakensberg (Fig. 3). The climate is severe throughout its range of distribution and snow is experienced during the period June to August and falls often occur as late as September. They are, however, of short duration.

M. hirsuta always forms large colonies in shallow soils in completely exposed conditions on the lower edges of plant islands or in rock crevices on east to north east-facing Cave Sandstone ridges. Plants have also been recorded on exposed stony soils derived from the Basalt formation at Qwa Qwa.

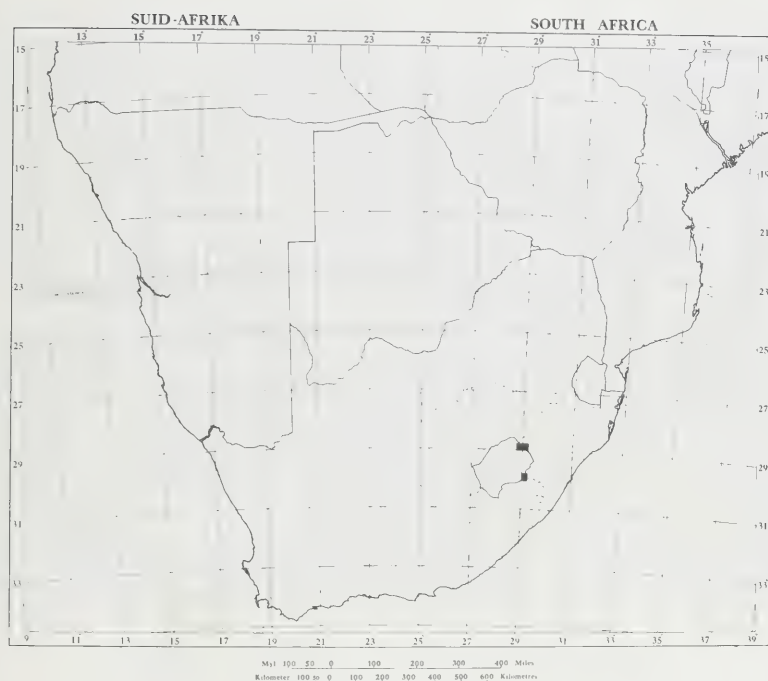


FIG. 3.

Mohria hirsuta J.P.Roux, sp. nov. Distribution range.

Because of the infrequent snowfalls and the shallow soils, the plant islands often become extremely dry during the period from May to September, causing the plants to shrivel up entirely. However, a continual seepage from higher up may be experienced during the period November to January.

M. hirsuta is restricted to meso-xerophilous habitats. The seasonal pattern appears to be regular and the numerous mesomorphic fronds which are produced simultaneously during December to February are poikilohydrous. Fertile fronds were collected in December and February. Effective vegetative reproduction takes place by the division of the hemicryptophytic rhizome which is also highly fire-resistant.

DISCUSSION

Mohria hirsuta differs from *M. caffrorum* (L.) Desv. in a number of characters, of which the most significant are the hirsute rachis and lamina.

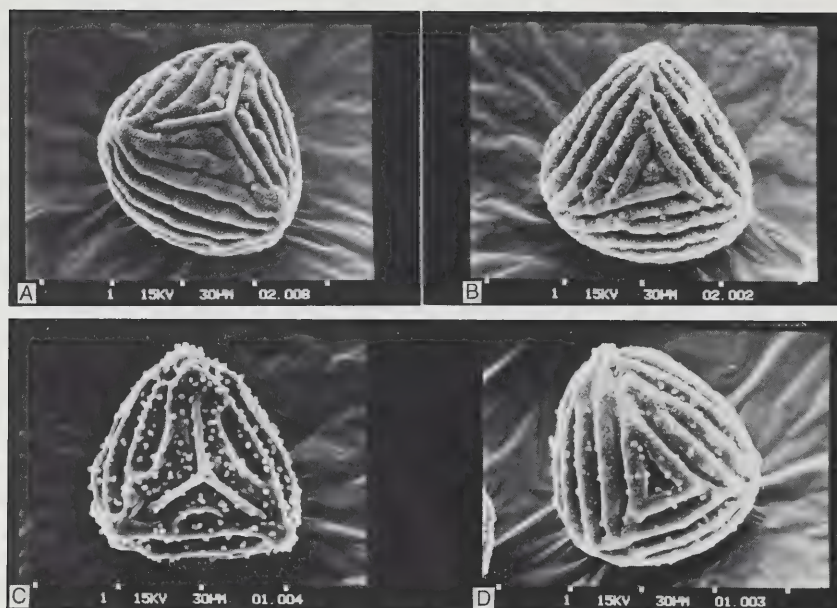


FIG. 4.

A-B. *Mohria hirsuta* J.P.Roux, sp. nov. Roux 907. A. Proximal view of spore; B. Distal view of spore. C-D. *Mohria caffrorum*, Roux 947. A. Proximal view of spore; B. Distal view of spore.

Similar uniseriate hairs are also common on the juvenile fronds of the young developing sporophyte. This, however, is absent from *M. caffrorum*. *M. hirsuta* also forms large dense colonies either in exposed or partially sheltered conditions whereas *M. caffrorum* generally occurs as individuals or in small groups consisting of a few plants. The lamina of *M. hirsuta* is less dissected and never reaches the dimensions of *M. caffrorum*. The rhizome and stipe scales are also generally smaller and paler with cell structure less complex than that of *M. caffrorum*. The fimbriate scale margins which are a common feature in especially xeromorphic forms of *M. caffrorum* have not as yet been observed in *M. hirsuta*. The spores of *M. hirsuta* are trilete, ridged and minutely rugulose (Fig. 4 A-B) while those of *M. caffrorum* show variations between trilete, ridged and sparsely set with large verrucae (Fig. 4 C-D) to deeply ridged with a coarse rugulose ornamentation both on the ridges and in between. The spores of *M. caffrorum* vary between 70 and 90 μm in diameter.

ACKNOWLEDGEMENTS

The cooperation of Prof. D. Crawford and Mr. D. Gernicke of the Electron Microscope Unit at the University of Cape Town, who prepared the micrographs of the spores, is much appreciated.

A NEW SPECIES OF *ARGYROLOBIUM* (FABACEAE) FROM THE SOUTHERN CAPE

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ABSTRACT

Argyrobium brevicalyx C. H. Stirton, is described as new. This rare, rather atypical, species of *Argyrobium* is confined to Bokkeveld shales in renosterveld of the Bredasdorp Region of the Cape of Good Hope.

UITTREKSEL

'N NUWE SPECIES *ARGYROLOBIUM* (FABACEAE) VANAF DIE SUID-KAAP

Argyrobium brevicalyx C. H. Stirton word as nuut beskryf. Hierdie skaars byna atipiese species *Argyrobium* is beperk tot die Bokkeveld-skalie in renosterveld van die Bredasdorpstreek van Kaap die Goeie Hoop.

Key words: *Argyrobium*, sp. nov., Fabaceae, southern Cape.

***Argyrobium brevicalyx* C. H. Stirton, sp. nov.**

Frutex parvus. *Folia* digitate trifoliolata. *Foliola* 7–11 mm longa, 3–6 mm lata, conduplicata, obovata, valde recurvato-mucronata, basi cuneata; lateralibus breviora. *Stipulae* liberae juxta basin petioli obviae, late ovatae, longe persistentes. *Inflorescentiae* 1–3 florum, in surculis brevibus positae. *Flores* 8,0–8,5 mm longi, luteoli. *Dentes* calycis inaequales, breviores quam corolla. *Vexillum* late ovatum, vix auriculatum, unguiculatum. *Alae* longiores quam carina. *Androecium* monadelphum, adaxialiter fissum.

Type: CAPE—3420 (Bredasdorp): Flats along watercourse 1 km SSE of Uitvlug farm, along road between Bredasdorp and Swellendam, 15 km SW of Swellendam (-AA), 1/10/83, *Burgers 3188* (K, holotype: STE, isotype).

Small shrub up to 400 mm tall, branching at the base. *Leaves* digitately trifoliolate; petiole 2–5 mm long, furrowed. *Stipules* 3–5 mm long, broad

* B.A. Krukoff Botanist.

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FIG. 1.

Flowering shoot of *Argyrolobium brevicalyx* (Burgers 3188) showing structure of inflorescences and recurved conduplicate nature of leaflets.

based, broadly ovate, free, patent upcurving, sericeous outside, glabrescent inside. *Leaflets* 7–11 mm long, 3–6 mm wide, subsessile, terminal leaflet larger, obovate, arcuate, somewhat conduplicate, base cuneate, sericeous but sparsely so on abaxial surface. *Inflorescences* terminal on short axillary shoots, 1–3-flowered (Fig. 1), peduncle 10–14 mm long. *Flowers* 8,0–8,5 mm long, light yellow, ebracteolate; pedicel, 2–3 mm long. *Calyx* 6 mm long, tube 3,0–3,5 mm long; vexillar teeth 2,0–2,5 mm long, equally broad at base; lateral and keel lobes mutually coherent to a tripartite lip, narrower, same length as vexillar lobes; sericeous outside, glabrous inside; calyx much shorter than the standard, scarcely bilabiate, not as in most *Argyrolobiums*. *Standard* 10 mm long, 7,0–7,5 mm wide; claw 3 mm long, 1 mm wide; blade broadly ovate, apex rounded to slightly emarginate, scarcely auriculate, sericeous along the midrib at the back; appendages present, scarcely swollen. *Wing petals* 9,0–9,5 mm long, blade 3–4 mm wide, claw 3 mm long, longer than the keel but tips curve in and rest against the sides of the keel so exposing the apex of the keel, auriculate; sculpturing upper basal and upper central, intracostal comprising 3–4 rows of 8–10 irregular lunae

gradually becoming smaller and diffuse towards the upper rim. *Keel petals* fused from the apex for one-third their length as far as the point of flexure; blade 5–6 mm long, 3 mm wide, infolded slightly near junction of blade with the claw. *Androecium* 9 mm long, monadelphous, slit on adaxial side; anthers dimorphic with 5 linear-oblong basifixed anthers alternating with 5-ovate dorsifixed anthers, terminal anther narrowly-ovate-oblong and intermediate in size. *Pistil* 9 mm long; ovary 6 mm long, compressed, subsessile, villous as far as point of flexure; height of curvature 3 mm; stigma minute. Fruits and seeds unknown. (Fig. 2).

Argyrolobium brevicalyx is an exciting discovery. The species was collected by Mr. C. J. Burgers of the Department of Nature and Environmental Conservation, Provincial Administration of the Cape of Good Hope.

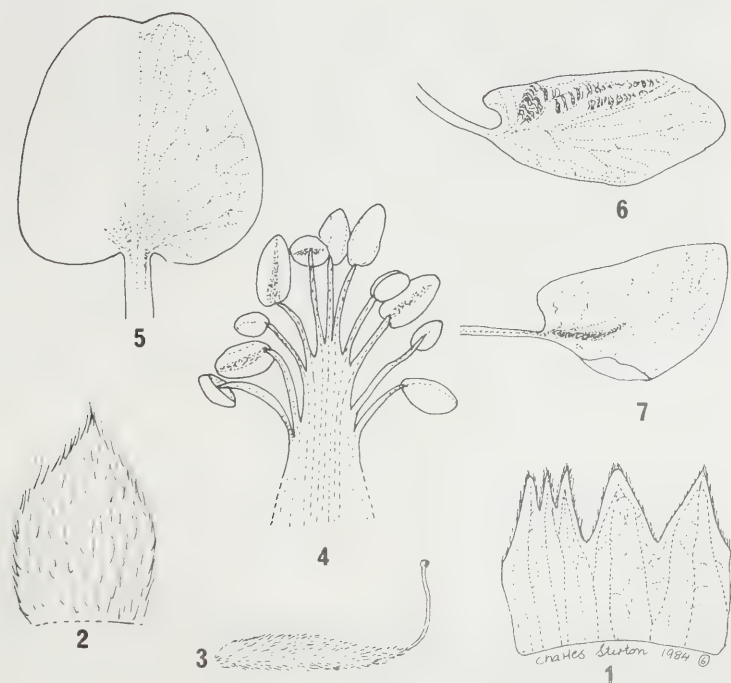


FIG. 2.

Argyrolobium brevicalyx (Burgers 3188): 1. Calyx opened out, $\times 4$; 2. Stipule, $\times 15$. 3. Pistil, $\times 4$; 4. Apex of androecium opened out, $\times 10$; 5. Standard, $\times 4$; 6. Wing petal, $\times 4$; 7. Keel, $\times 4$.

Mr Burgers has already discovered two other rare and unusual species: *Argyrobium canescens* C. H. Stirton and *Polhillia pallens* C. H. Stirton, and I am grateful to him for the care and generosity with which he has expedited my requests for seeds and photographs.

A feature of most species of *Argyrobium* is that their androecia are tubular. The majority also have calyces that are distinctly bilabiate, usually deeply cleft. *A. brevicalyx* is an exception. In this species the calyx is scarcely bilabiate and unlike other *Argyrobiums* the calyx is markedly shorter than the corolla. Flowers of this species also have an androecium which, although monadelphous, is split adaxially almost to the base. Another unusual feature is the pseudo-capitate nature of the inflorescences.

When I first saw this plant I was uncertain as to which genus it belonged. Although I keyed it out to the tribe Crotalarieae (Polhill, 1976; 1981) without any difficulty I was unable to key it out to a genus to which it seemed naturally to belong. In Polhill (1976) it keys out to *Dichilus*, if one gives weight to the corolla being longer than the calyx; to *Argyrobium*, if one interprets the stipules as not being semi-sagittate or semi-cordate. The former genus does not possess stipules, as it is currently circumscribed, and in the latter the calyx is rarely shorter than the corolla and if it is then the calyx is distinctly bilabiate. From *Polhillia* (Stirton, 1984) it differs in the stipules being free and not involucrate and in the terminal anther being intermediate in size. *A. brevicalyx* does share some features with *A. canescens* and *A. connatum* but differs in inflorescence structure and its non-involucrate stipules. These three species of *Argyrobium*, together with *A. lotioides* Harv., stand apart from the rest of the genus. However, notwithstanding the features which make *A. brevicalyx* an anomalous inclusion in *Argyrobium*, I am including it in this genus as it approximates this genus better than any of the genera that are available.

SPECIMEN EXAMINED

As for type

DISTRIBUTION

Argyrobium brevicalyx was found growing in renosterveld in clayey soils derived from Bokkeveld shales. Only a single specimen (Fig. 3) was found in a narrow remnant strip of renosterveld along a watercourse and was surrounded by wheatfields. From Mr. Burger's observations (pers. comm., 1984), it is clear that *Argyrobium brevicalyx* is an endangered species. He visited a number of renosterveld patches in the Protea area on October 1983 but did not see any other plants of what is a conspicuous

species in flower. Is it possible that the discovery of *A. brevicalyx* is almost an epitaph? One wonders how many other species have been lost in the wheatfields of the south western and southern Cape.

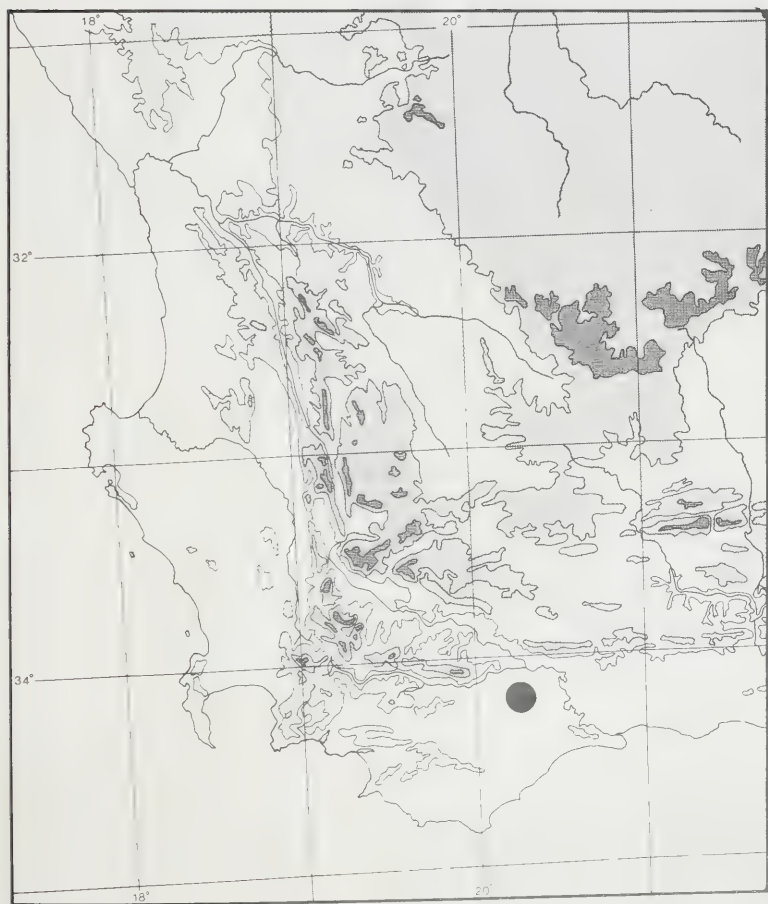


FIG. 3.
Known distribution of *Argyrolobium brevicalyx* (●).

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NEW TAXA AND NOTES ON SOUTHERN AFRICAN *GLADIOLUS* (IRIDACEAE)¹

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ABSTRACT

Three new species of *Gladiolus* and one new variety are described from the Cape Province of South Africa. *Gladiolus nigromontanus*, found in a wet site in the Swartberg Mts. in the southern Cape, is allied to the *G. gracilis*-*G. mutabilis* alliance and is unusual in blooming in the summer. *Gladiolus robustus*, endemic in the Baviaanskloof Mts., appears closely related to *G. carneus*, but is much larger and has several basal leaves that place it in a different group of the genus. *Gladiolus deserticolus* is apparently restricted to the summit of Cornellsberg, in the Richtersveld. The new variety, *G. rogersii* var. *vlokii*, is also described to accommodate an unusual series of populations flowering in the autumn and having heavily clawed corms. Major range extensions are reported for *G. punctulatus* var. *autumnalis*, *G. hyalinus* and *G. stokoei*.

UITTREKSEL

NUWE TAKSA EN AANTEKENINGE OOR SUIDER-AFRIKAANSE *GLADIOLUS* (IRIDACEAE)

Drie nuwe *Gladiolus*-spesies en een nuwe variëteit vanaf die Kaapprovinsie, Suid-Afrika, word beskryf. *Gladiolus nigromontanus* gevind in 'n nat omgewing in die Swartberg in die Suid-Kaap, is verwant aan die *G. gracilis*-*G. mutabilis* groep en is ongewoon omdat dit in die somer blom. *Gladiolus robustus*, endemies in die Baviaanskloofberge, skyn naverwant te wees aan *G. carneus* maar is heelwat groter en het verskeie basale blare wat dit in 'n ander groep in die genus plaas. *Gladiolus deserticolus* is blykbaar beperk tot die kruin van Cornellsberg in die Richtersveld. Die nuwe variëteit, *G. rogersii* var. *vlokii*, word ook beskryf om die ongewone reeks populasies wat in die herfs blom en wat swaar gekloude knolle het, te akkommodeer. Groot verspreidingsvergrotings word rapporteer vir *G. punctulatus* var. *autumnalis*, *G. hyalinus* en *G. stokoei*.

Key words: *Gladiolus*, sp. nov., Iridaceae.

INTRODUCTION

Gladiolus, comprising some 150 species, is one of the larger genera of Iridaceae and the largest genus of the family in Africa. It occurs throughout the continent, particularly south of the Sahara, and extends into Europe and

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western Asia. Species are concentrated in southern Africa, where 103 species were recognised in the revision by Lewis *et al.* (1972), the only major treatment of *Gladiolus* since *Flora Capensis* (Baker, 1896). Despite having been studied intensively in the decade before the publication of the revision, *Gladiolus* appears to have been poorly collected in some parts of South Africa and in recent years several new taxa have been discovered and the ranges of several more substantially extended. *Gladiolus delpierrei* was described from the western Cape mountains (Goldblatt, 1979), *G. pugioniformis*, from the Natal Drakensberg (Hilliard & Burt, 1979), *G. dolomiticus* and *G. cataractarum*, from the central and eastern Transvaal (Obermeyer, 1979; 1982), and *G. microcarpus* subsp. *italaensis*, from northern Natal (Obermeyer, 1981).

Continued botanical exploration in South Africa has yielded several more unusual forms that either represent significant range extensions or do not correspond with any of the taxa in the 1972 revision. In the southern Cape Province, J. J. Vlok, Department of Forestry, George, and M. Viviers, Department of Forestry, Algeria, discovered two new species, *Gladiolus nigromontanus* and *G. robustus* and a new variety, *G. rogersii* var. *vlokii*, all described here for the first time. Their collections have also extended the range of *G. punctulatus* var. *autumnalis* some 100 km to the east from the Langeberg at Heidelberg and Riversdale, to Ruitersbos and George. Along the west coast Peter Linder has recorded *Gladiolus stokoei* on Zebrakop in the Piketberg Mts., a species previously thought to be a local endemic of the Riviersonderend Mts. ca. 175 km to the south east. *Gladiolus hyalinus*, treated by Lewis *et al.* (1972) as occurring from the Cape Peninsula to Nieuwoudtville, has been collected much further north in Namaqualand in the Kamiesberg by myself and near Steinkopf by Graham Williamson. Lastly, the new *G. deserticolus* was discovered on the summit of Cornellsberg in the Richtersveld by E. G. Oliver, H. Tolken and S. Venter, on an expedition from the Botanical Research Institute, Pretoria.

A total of 110 species of *Gladiolus* is now recognised in southern Africa. Of these 74 occur in the Cape Floristic Region, most of them endemic. In this small area, comprising less than 5% of the land surface of southern Africa, a winter rainfall pattern, unusual nutrient-poor soils and a very dissected landscape have combined to provide the background for rapid radiation and speciation in many genera of several unrelated plant families, including Iridaceae.

RANGE EXTENSIONS

1. *Gladiolus punctulatus* Schrank.

Lewis *et al.* (1972) recognise two varieties in this widespread, western

and southern Cape species. The typical var. *punctulatus* occurs in the west, from Bredasdorp to Piketberg and is distinctive in having a pubescent inner basal sheath (cataphyll), and a long, narrow basal leaf blade. It blooms in winter and spring, from June to October.

In contrast, the autumn-blooming var. *autumnalis* Lewis has a glabrous, inner basal sheath and a distinctive short basal leaf blade. The variety has until now been known from only two localities in the central Langeberg, at Grootvadersbos and at Garcias Pass, both collections flowering in April. New populations have now been found near Ruitersbos (Vlok 347), in the eastern Langeberg north of Mossel Bay, flowering in March; and near George at Witfontein (Moriarty 851) blooming in April. These collections represent a significant range extension and an important addition to our knowledge of a poorly known variety. The plants from this eastern part of its range are unusual in having entirely glabrous leaves and larger bracts and flowers than other collections of var. *autumnalis*.

2. *Gladiolus stokoei* Lewis

Gladiolus stokoei is a striking, large red-flowered species previously known from only two collections, both made by Thomas Stokoe in a small area of the Riviersonderend Mts., east of Caledon. The species belongs to the *Exfoliati* group, the flowering scapes having no produced leaf. The foliage leaves are produced during the growing season, August to November, while the plants bloom in early autumn, in March and April. A new population was discovered some years ago by Peter Linder, who found plants on Zebrakop in the Piketberg Mts. His collection is clearly this species and it represents a significant increase in our knowledge of this rare species and a range extension of some 175 km westward. An article and fine illustration of *G. stokoei* was recently published in *Veld & Flora* (Holmes, 1983).

3. *Gladiolus hyalinus* Jacq.

Gladiolus hyalinus is a fairly common species of heavier soils on flats and lower mountain slopes between the Cape Peninsula and Nieuwoudtville in the western Cape. It has relatively small brownish to cream, often fragrant flowers produced from June to September. It is related to the larger flowered and better known *G. liliaceus*, the brown Afrikander or aandpypie, that extends from Clanwilliam to Port Elizabeth. *Gladiolus hyalinus* has now been found at two widely separated sites well to the north in Namaqualand. I collected it in the Kamiesberg Mts. on Rooiberg at 1 400 m (4500 ft.), flowering in early June (*Goldblatt* 5573) and it was abundant here on the moister southern slopes of ridges. It has also been collected recently west of Steinkopf in northern Namaqualand by Graham Williamson on a mountain

summit near Klipfontein, flowering at the end of May (Williamson 3016). These records make it clear that *G. hyalinus* is not at all restricted to the Cape Floristic Region as previously believed, but is a very wide-ranging species of the west coast and near interior of winter-rainfall southern Africa.

NEW TAXA

1. *Gladiolus rogersii* Baker var. *vlokii* Goldbl.

One of the species of *Gladiolus* commonly known as 'bluebells', *G. rogersii* is allied to *G. inflatus*, the Tulbagh bell and *G. bullatus*, the Caledon bluebell. *Gladiolus rogersii* occurs in the southern Cape between Bredasdorp and Humansdorp and typically blooms in the spring months, from July to November. It is particularly difficult to distinguish from *G. inflatus*, to which it appears most closely allied. The major differences between these two species are, according to Lewis *et al.* (1972), soft corm tunics not drawn upwards in a neck and the lowermost tepal usually distinctly shorter than the lower laterals in *G. rogersii*; and hard, heavily clawed tunics, drawn up into a well-developed neck and the lower three tepals subequal in *G. inflatus*.

The distinction is blurred by a series of specimens of *Gladiolus rogersii* assigned to var. *graminifolius* Lewis, which have fairly hard corm tunics and a neck of varying thickness around the base. Most representatives of this taxon have a distinctive, relatively broad leaf lamina (2–9 mm wide) with margins not as much thickened as in var. *rogersii*. Additional material of what appeared to be *G. rogersii* var. *graminifolius* prompted a critical appraisal of the variety. This suggests that var. *graminifolius*, as circumscribed by Lewis *et al.*, is a heterogeneous assemblage, comprising two distinct taxa. The collections cited by Lewis *et al.* include specimens matching the type, from the mountains of the Little Karoo that flower in the spring, but also some plants that flower in autumn, in April to May (Wurts 1347 from Ladismith; Wurts 90 from Swellendam). Lewis (unpublished annotations) suggested that these were merely flowering out of season. However, she failed to note that the autumn-flowering material (collected without corm coverings) appeared to lack the basal fibrous neck described as characteristic of the variety. A third population matching the above collections was discovered by Jan Vlok in the Langeberg at Ruitersbos, flowering at the beginning of March. These plants quite clearly lack a basal fibrous sheath. In addition, the corm tunics are relatively heavy and clawed. There seems little doubt that the autumn-flowering plants represent a series of populations distinct genetically, ecologically and morphologically from var. *graminifolius*. I suggest they be assigned to a new variety, var. *vlokii*, described below. The flowers of var. *vlokii* are typical of *G. rogersii* in having the lowermost tepal markedly smaller than the lower laterals and thus the variety seems well placed in *G. rogersii*.

***Gladiolus rogersii* var. *vlokii* Goldbl., var. nov.**

Planta 300–450 mm alta, tunicis cormi perunguiculatis, cataphyllo membranaceo non in collum producto, foliis 3–4 infimo longiore 1–1,5 mm lato costis marginibusque incrassatis, floribus 5–6 coeruleis, autumno florente.

Type: South Africa, Cape, Ruitersbos Forest Reserve, in deep sand, *Vlok 348* (NBG, holotype: MO, PRE, isotypes).

Plants 300–450 mm high. *Corm* 10–13 mm in diameter, tunics strongly clawed. *Leaves* 3–4, the lowermost longest, 1–1,5 mm wide, with strongly thickened margins and midrib. *Spike* 5–6-flowered, *bracts* 12–15 mm long. *Flower* blue with dark blue and yellow markings on the lower tepals, lower lateral tepals ca. 30 mm long exceeding the lowermost tepal by 6–10 mm.

Flowering time: March and April.

Distribution: scattered in the Langeberg between Swellendam and Ruitersbos and in the Swartberg Mts. above Ladismith, at low to middle altitudes.

SOUTH AFRICA, CAPE—3320 (Montagu): Foot of 10 O'Clock Mt., Swellendam, 800 ft (-CD), *Wurts 90* (NBG).

—3321 (Ladismith): Foothills north of Ladismith, 2000 ft (-AD) *Wurts 1347* (NBG).

—3322 (Oudtshoorn): Ruitersbos Forest Reserve, near Coloured Township, Mossel Bay District (-CC), *Vlok 348* (MO, NBG, PRE).

2. *Gladiolus robustus* Goldbl., sp. nov. Fig. 1.

Planta 0,9–1,5 m alta 1–2 ramosa, cormo globoso 15–20 mm in diametro, tunicis mollibus membranaceis cormiferibus, foliis 7–9 ensiformibus planis ad 14 mm latis et 600 mm longis, spica ad 8 floribus, floribus carneis, tubo 30–35 mm longo, tepalis inaequalibus, superioribus ca 50 mm longis, inferioribus ca 45 mm longis, filamentis unilateralibus arcuatis, antheris 9–11 mm longis.

Type: South Africa, Cape, Baviaans Kloof Mts., farm Enkeldoorn, lower mountain slopes, 820 m, *Vlok 475* (NBG, holotype; MO, PRE, isotypes).

Plants 0,9–1,5 m high, robust. *Corm* globose, 15–20 mm in diameter, tunics soft membranous to subfibrous, bearing many small cormlets around the base. *Leaves* 7–9, ensiform, plane, up to 14 mm wide, to 600 mm high, the lower basal, the upper inserted on the lower part of the stem. *Stem* erect, usually 1–2-branched, slightly flexed at the base of the spike. *Spike* up to 8-flowered; *bracts* herbaceous, 30–40 mm long, the inner somewhat shorter than the outer. *Flowers* zygomorphic, pink with darker sagittate markings on the lower three tepals and dark markings in the throat: *perianth*

tube 30–35 mm long, reaching to the apex of the bracts; *tepals* unequal, the upper ca. 50 mm long and to 29 mm wide, hooded, lower three ca. 45 mm long, to 14 mm wide, horizontal. *Filaments* unilateral and arcuate, ca. 20 mm long; *anthers* 9–11 mm long, arcuate lying under the uppermost tepal. Ovary 6–8 mm long, *style* arching over the filaments and dividing near the apex of the anthers, *style branches* ca. 8 mm long, broadest at the apices and bilobed. Capsule and seeds not known.

Flowering time: November to January.

Distribution: local in the Baviaanskloof Mts., in moist sites.

Gladiolus robustus is allied to the *G. carneus* complex of species, which includes *G. buckerveldii*, *G. angustus*, *G. undulatus* and *G. floribundus* as well as the widespread *G. carneus*. It appears initially to be only a form of the very variable *G. carneus*, but closer study reveals that *G. robustus* has a combination of the characteristic features of several species of this alliance. The large corms bear numerous small cormlets on stolons around the base, exactly as in some specimens of *G. undulatus*, a west coast species with a long perianth tube and acuminate and undulate tepals, a feature not found in *G. carneus*.

In its height and robust habit, *Gladiolus robustus* is matched only by some specimens of *G. angustus*, another west coast species, distinct in having a long perianth tube, well exerted from the bracts, while the narrow, usually undulate tepals are shorter than the tube.

The flower of *Gladiolus robustus*, with the tepals nearly equal in length to the tube, and the pale pink colour with hastate markings on the lower tepals, matches the more robust forms of *G. carneus*, which normally grows no more than 800 mm high, and has only 3–5 leaves. This is markedly different from the 7–9 broad leaves and the 0.8–1.5 m in height attained by *G. robustus*.

The leaf number places *Gladiolus robustus* in the *Plurifoliati*, one of the four informal groups of the genus erected by Lewis *et al.* All the other species of the *G. carneus* alliance, excepting the local Cedarberg endemic, *G. buckerveldii*, have 3–5 leaves and fall in group 2, the *Paucifoliati*. Despite this apparent inconsistency, there seems no reason to doubt the close affinity of *G. robustus* with *G. carneus*. In Lewis *et al.*'s treatment, *G. robustus* keys out to *G. ochroleucus*, an eastern Cape species, but it does not match specimens of this taxon, which has tough fibrotic leaves and an erect, rather densely flowered spike. The range of *G. robustus*, in the Baviaanskloof Mts. of the southern Cape, is well east of the range of *G. carneus*, which has been collected no nearer than the Riversdale district, some 200 km to the west. The species was brought to my attention by Jan Vlok and Mike Viviers, who made the type collection in November, 1982, and be-



FIG. 1-3.

Flowers of the three new species of *Gladiolus* described in this paper, all taken in the wild, but the flower of *G. deserticolus* removed from the plant. 1. *G. robustus*; 2. *G. nigromontanus*; 3. *G. deserticolus*.

lied that the species was new to science. The species appears to have been discovered earlier by R. D. Bayliss, who found it in the same general area of the Baviaanskloof Mts. flowering later, in January, in 1978.

SOUTH AFRICA, CAPE—3324 (Steytlerville): Baviaanskloof Forest Reserve, farm Enkeldoorn, lower mountain slopes, 820 m (-CB), *Vlok 475* (MO, NGB, PRE); Baviaans Kloof, bank of perennial stream, *Bayliss 8464* (MO).

3. *Gladiolus nigromontanus* Goldbl., sp. nov. Fig. 2.

Planta 300–400 mm alta, cormo ca. 16 mm in diametro, tunicis fibris tenuibus supra extensis, foliis 2–3, infimo basali marginibus costisque incrassatis, floribus 3–4 albis rubris signis, tubo ca. 15 mm longo, tepalis superioribus ad 30 mm longis, inferioribus ca. 25 mm longis.

Type: South Africa, Cape, south-facing slopes above Old Toll House, wet sandy ground on steep inclines, 950 m, *Vlok 175* (MO, holotype; K, NGB, SAAS, isotypes).

Plants 300–400 mm high. *Corm* globose-conic, ca. 16 mm in diameter at widest point, tunics light to dark brown, layers unbroken above, becoming broken into parallel fibres below, and extending upward to a neck of fine fibres. *Cataphyll* apparently solitary, brownish. *Leaves* 2(–3), lowermost basal, more or less dry at flowering time, sheathing in the lower half, enveloping stem for half to one-third of its length, lamina more or less oval in section, with thickened margins and midrib and two longitudinal grooves on each surface, second leaf becoming bract-like, sheathing the stem below and free in the upper 10–30 mm, a third entirely sheathing leaf or bract-leaf present in the upper part. *Stem* erect, flexed slightly at base of inflorescence, unbranched, with a leaf-like, sheathing bract in upper third. *Spike* secund, 3–4-flowered; *bracts* 13–17 mm long, herbaceous, inner 2–3 mm shorter than outer. *Flower* bilabiate, white with red spade-shaped markings in middle of lower three tepals; *perianth tube* ca. 15 mm long, shortly exerted from the bracts, cylindric, curved near apex; *tepals* unequal, upper hooded, to 30 mm long and ca. 12 mm wide, upper laterals narrower, lower tepals ca. 25 mm long, ca. 4.5 mm wide. *Filaments* unilateral, ca. 14 mm long; *anthers* arcuate, contiguous, ca. 6 mm long. *Ovary* ca. 3 mm long, *style* arcuate, held above the stamens, branching beyond apex of anthers, *branches* ca. 3 mm, broadened towards apices. Capsules and seeds not known. Chromosome number not known.

Flowering time: March.

Distribution: known only from the Swartberg Mts., on Swartberg Pass at ca. 950 m.

Gladiolus nigromontanus was discovered by Mike Viviers, in the summer of 1981, in full bloom on the Swartberg Pass near Oudtshoorn. It is a distinctive species, belonging in Lewis *et al.*'s third infrageneric grouping *Unifoliati*, having a single long basal leaf at anthesis, and 2–3 reduced cauline leaves. In *G. nigromontanus* the basal leaf sheathes the stem for half to one-third of its length and seldom reaches the base of the spike. It is most closely related within the *Unifoliati* to the *G. gracilis*–*G. exilis*–*G. mutabilis* alliance and has the corm tunics and habit of these species. It is unusual, however, in the neck of fibres round the base of the stem, not found in the related species and in its white flower with red spade-shaped markings on the lower tepals (Fig. 2) that are quite unlike the spotted or streaked markings found in its allies. The flower is also distinctive in the length of the perianth tube which is long and exerted 2–4 mm from the bracts. In other species of the group the tube is enclosed entirely and emerges between the bracts.

Gladiolus nigromontanus is unusual in flowering in late summer, a feature uncommon in the *Unifoliatae*, but known in *G. exilis* and *G. delpierrei*, and like these species, it relies on additional moisture from seeps and underground drainage channels during the hot dry summers of the interior southern Cape mountains. Most of the several summer and autumn-blooming *Gladiolus* species of the winter rainfall area belong to the *Exfoliati* group, and are hysteroanthous, with leaves and flowers produced at different seasons. The leaf of *G. nigromontanus*, dry at flowering time, suggests an affinity with the *Exfoliati* but species of this group have no basal leaf at all on the flowering stems.

SOUTH AFRICA, CAPE—3322 (Oudtshoorn): Swartberg Pass, above Old Toll House, 950 m, on steep south-facing slopes in wet ground (-AC), Vlok 175 (K, MO, NBG, SAAS).

4. *Gladiolus deserticolus* Goldblatt, sp. nov. Fig. 3.

Planta 8–150 mm alta, cormo globoso 8–10 mm in diametro, tunicis fibrosis, cataphyllo purpureo maculato, foliis 4 linearibus planis 1–1.5 mm latis, spica 1–4 floribus, floribus caeruleis, tubo 6–7 mm longo, tepalis subaequalibus, superiore 16–18 mm longis, inferioribus 14–16 mm longis, filamentis unilateralibus arcuatis, antheris ca 4 mm longis.

Type: South Africa, Cape, Richtersveld, Stinkfontein Mts., Cornellberg, ridge south of beacon, 1 300 m, Oliver, Tolken & Venter 706 (PRE, holotype; MO, STE, isotypes).

Plants 80–150 mm high, slender. Corm conic, 8–10 mm in diameter, tunics fibrous, lightly clawed below. Cataphyll solitary, reaching shortly above the ground and mottled purple and white. Leaves 4, linear, plane, 1–1.5 mm

wide, the lowermost longest and exceeding the stem, the others cauline, progressively shorter, the lower basal and the uppermost inserted just below the spike and becoming bract-like and sheathing in the lower half. *Stem* erect, occasionally 1–2-branched, flexed above the sheathing parts of the cauline leaves. *Spike* 1–4-flowered, flexuose; *bracts* herbaceous, the margins hyaline, 10–14(–16) mm long, the inner usually somewhat shorter than the outer. *Flowers* nearly actinomorphic but the upper tepals somewhat larger than the lower and the stamens evidently unilateral and arcuate, blue with a pale yellow centre; *perianth tube* 6–7 mm long cylindric, widening towards the apex, reaching to the apex of the bracts; *tepals* lanceolate, subequal, somewhat clawed below, the upper somewhat larger and inclining over the anthers, 16–18 mm long, ca. 5 mm wide, the other tepals 14–16 mm long. *Filaments* unilateral, ca. 5 mm long; *anthers* ca. 4 mm long, yellow, arching under the upper tepal. *Ovary* 2–3 mm long, *style* arching over the filaments and dividing near the apex of the anthers, *style branches* ca. 3 mm long, broadest at the apices and bilobed. Capsule and seeds not known.

Flowering time: August to early September.

Distribution: apparently local in the Stinkfontein Mts., in the Richtersveld, in the shade of low south-facing cliffs.

Gladiolus deserticolus is an unusual species of *Gladiolus* in that the flowers are nearly actinomorphic (Fig. 3). The tepals are subequal and spreading almost to the same extent, but the upper tepals seem somewhat larger than the lower and the stamens appear to be unilateral with arcuate, nearly contiguous anthers. It is probably related to the widespread, winter rainfall area *G. scullyi*, a particularly common species in Namaqualand and the drier areas of the western Cape coast. From the limited material available, it seems that *G. deserticolus* differs in size both in the vegetative parts and in the flower, *G. scullyi* being much larger. The flowers of *G. scullyi* are strongly zygomorphic with distinctively smaller, clawed lower tepals that are sharply flexed at the base of the limb. It also has several leaves, usually 3–5 of which are basal in contrast to the 1–2 basal leaves of *G. deserticolus*. The mottled basal sheath of *G. deserticolus* is also a distinctive feature and another in which it differs from *G. scullyi*. Jan Vlok (pers. comm.) has suggested that *G. deserticolus* may be more closely allied to *G. stellatus*, a southern Cape species which has very short-tubed actinomorphic flowers. *Gladiolus stellatus* has several leaves which have the margins and midribs conspicuously thickened, and a straight rather than flexuose spike. There is certainly merit in Vlok's observation but I believe that apart from the similar actinomorphic flower, *G. deserticolus* shares more characters with *G. scullyi* than with *G. stellatus*.

The species was apparently first collected by an expedition from the Botanical Research Institute that explored the Richtersveld in the spring of 1977. It grows in sheltered sites in partial shade at the foot of low south-facing cliffs. Fruiting specimens found by Mike Viviers in 1983 in the same locality are tentatively assigned to *G. deserticolus*. Seed will be grown and flowered to confirm the identification and to make a permanent record. The fruiting material had winged seed characteristic of *Gladiolus*.

SOUTH AFRICA, CAPE—2817 (Vioolsdrif): Richtersveld, Stinkfontein Mts., Cornellsberg, ridge south of beacon (-DC), 1 300 m, Oliver, Tolken & Venter 706 (PRE, MO, STE).

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NAME CHANGES IN *PSORALEA* (FABACEAE)

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ABSTRACT

1. The new combination *Psoralea monophylla* (L.) C. H. Stirton is made, based on *Glycine monophyllum* L. 2. The new name *Psoralea plauta* C. H. Stirton is designated for *Hallia flaccida* Thunb. (1799), non *P. flaccida* Năbelék (1923). 3. The new name *P. cataracta* C. H. Stirton is designated for *H. filiformis* Harv. (1836), non *P. filiformis* Poir. (1804).

UITTREKSEL

NAAMSVERANDERING IN *PSORALEA* L. (FABACEAE)

1. 'n Nuwe kombinasie *Psoralea monophylla* (L.) C. H. Stirton word gemaak, gebaseer op *Glycine monophyllum* L. 2. Die nuwe naam *Psoralea plauta* C. H. Stirton word gegee aan *Hallia flaccida* Thunb. (1799), non *P. flaccida* Năbelék (1923). 3. Die nuwe naam *P. cataracta* C. H. Stirton word aan *H. filiformis* Harv. (1836), non *P. filiformis* Poir. (1804) gegee.

Key words: *Psoralea*, Fabaceae.

1. *Psoralea monophylla* (L.) C.H.Stirton, comb. nov.

Glycine monophyllum L., Syst. nat. ed. 12, 2: 484 (1767); Mant. pl. 101 (1767); Mant. pl. Alt. Addim. 516 (1771); non Burm. 1768; auct. non L.: Jacq., Pl. Hort. Schoenbr. 2: 57, t. 257 (1797). Lectotype: "C.B.S." (LINN, specimen 901. 20, !).

Hedysarum cordatum Thunb. in Nov. Act. Reg. Soc. Sci. Upps. 6: 41 (1799); non Jacq. (1800). Lectotype: "Crescit in campis graminosis ultra Swellendam, C.B.S." (UPS, specimen 17161). Nomenclaturally superfluous name. *Hallia cordatum* (Thunb., Schrad. Journ. 1: 321 (1799); Gen. nov. Pl. 11: 158 (1800); Prodr. 131 (1800); W. T. Aiton, Hortus Kew. 4: 233 (1812); Thunb., Fl. Cap. 593 (1823); DC., Prodr. 2: 123 (1825); Eckl. & Zeyh., Enum. 172 (1836); E. Mey., Comm. 82 (1836). *Psoralea cordata* (L.)

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Salter in Jl S. Afr. Bot. **5**: 46 (1939); Salter in Adamson & Salter, Fl. Cape Penins. 490 (1950).

Salter transferred this species from *Hallia* to *Psoralea* but the basionym *Hedysarum cordatum* L. does not exist.

Hedysarum saggitatum Poir., Encyl. **6**: 403 (1804). Type: not seen.

Hallia saggitata (Poir.) Desv., Ann. Sci. Sér. **9**: 408 (1826). *Desmodium saggitatum* (Poir.) DC., Prodr. **2**: 326 (1825).

2. *Psoralea plauta* C.H.Stirton, nom. nov.

Hallia flaccida Thunb. in Schrad. Journ. 319 (1799); Prodr. 131 (1800); W. T. Aiton, Hortus Kew. **4**: 338 (1812); Thunb. Fl. Cap. 593 (1823); DC., Prodr. **2**: 123 (1825); Eckl. & Zeyh., Enum. 172 (1836). Lectotype: South Africa, "e Cap. Bon. Spei." *Thunberg s.n.* (UPS, specimen 17162), non Năbelék (1923).

3. *Psoralea cataracta* C.H.Stirton, nom. nov.

Hallia filiformis Harv. in Harv. & Sond. Fl. Cap. **2**: 232 (1836). Type: South Africa, Tulbagh Waterfall, *Pappe s.n.* (TCD, holotype!), non Poir. (1804).

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THE AFRICAN GENUS *CROCOSMIA* PLANCHON

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ABSTRACT

Herbarium material, and living material of some of the species, were examined for this revision of *Crocoshmia* Planchon, a small genus of the Iridaceae closely related to *Tritonia* and *Chasmanthe*. The genus is endemic in Africa south of the equator and is concentrated in the Republic of South Africa where seven of its nine species occur. Illustrated descriptions of the species, their geographical distribution and synonymy, and a key to the species are provided. One species, *C. fucata*, which stands midway between *Crocoshmia* and *Chasmanthe*, is now transferred to *Crocoshmia*. The well-known horticultural hybrid *C. crocosmiflora*, is also described.

The relationships of *Crocoshmia* with *Tritonia* and *Chasmanthe* are discussed and reasons are given why *Crocoshmia* should remain separate from *Tritonia* with which it was often combined, and be accepted as a valid genus.

UITTREKSEL

DIE AFRIKA GENUS *CROCOSMIA* PLANCHON

Herbariummateriaal asook lewende materiaal van sommige spesies is vir hierdie hersiening van die genus *Crocoshmia* Planchon ondersoek. 'n klein genus van die Iridaceae naverwant aan *Tritonia* en *Chasmanthe*. Die genus is endemies in Afrika suid van die ewenaar en is gekonsentreer in die Republiek van Suid-Afrika waar sewe van die nege spesies voorkom. Geïllustreerde beskrywings van die spesies, hul geografiese verspreiding en sinonimie, asook 'n sleutel om die spesies uit te ken, word verskaf. Een spesies, *C. fucata*, wat tussen *Crocoshmia* en *Chasmanthe* staan, word na *Crocoshmia* oorgeplaas. Die welbekende tuinbaster *C. crocosmiflora* word ook beskryf.

Die verwantskap van *Crocoshmia* met *Tritonia* en *Chasmanthe* word bespreek en redes word aangegee waarom *Crocoshmia* afgeskei van *Tritonia* behoort te bly en as 'n geldige genus aanvaar behoort te word.

Key words: *Crocoshmia*, Iridaceae.

INTRODUCTION

Crocoshmia is a small African genus of the Iridaceae, subfamily Ixioidae, comprising nine species. It is closely related to *Tritonia* and *Chasmanthe*. The greatest concentration of species is in the eastern parts of the Republic of South Africa, namely Natal, eastern Transvaal and the eastern Cape

Province. The range extends into the north eastern Orange Free State, Lesotho, Swaziland, Mocambique, Zimbabwe, Zaire and Angola, and one species, now transferred from *Chasmanthe*, occurs in the north western Cape Province.

It was only during the second half of the nineteenth century that species of *Crocoscopia* became known in England and Europe. They were described as species of *Tritonia*, and one as a species of *Antholyza*. But in 1850 the French botanist J. E. Planchon became convinced that *C. aurea*, at that time the only species known, did not fit well in *Tritonia*. He established a new genus, *Crocoscopia*, to accommodate it, the name referring to the fact that dried flowers, infused in hot water, emitted an odour of saffron (*Crocus*). The genus was not generally accepted and some investigators returned it to the synonymy of *Tritonia* (see p. 472). It remained monotypic until N. E. Brown (1932) redefined and enlarged the genus to include five species and a hybrid. Even as late as 1971, Goldblatt, although treating it as a genus, was uncertain about its validity. It was thought that the genus differed from *Tritonia* only in its short capsule with few seeds. More differences have now come to light and the genus is here accepted as valid.

In the present study nine species of *Crocoscopia* are recognised, one of which, described from immature specimens, is incompletely known and another, described from specimens at Kew, has not been found in the wild. One species, *C. fucata*, again lately collected in Namaqualand, is now transferred from *Chasmanthe* to *Crocoscopia*. The investigation is based on a study of herbarium material from South African and overseas herbaria, and of fresh material of four of the species and of the hybrid, *C. crocosmiiflora*. The latter, developed about a century ago, occurs as a garden escape in several countries and its description is also included.

MORPHOLOGY

Habit

*Crocoscopia*s are herbaceous, deciduous or sometimes evergreen geophytes, often growing in large clumps. The plants are generally large, varying from 300 mm to well over a metre in height, and sometimes up to 1,8 m. The species are adapted to summer rainfall conditions, sprouting in spring and flowering in summer.

The underground stems are large persistent tunicated corms. New corms are formed annually, but the older corms remain alive for two or more years.

Reproduction is by means of seeds which ripen in autumn, and by axillary buds on the corms which grow out to form long underground stolons from the tips of which new plants develop.

Corms

The corms which are perennial, consist of about six to fourteen internodes. These features are in contrast to most Ixiodeae (also *Tritonia*) in which corms are typically annual and have few internodes. Lewis (1954) discussed four exceptions in the Ixiodeae, namely *Pillansia* and *Dierama* that have persistent corms consisting of a single or few internodes, *Schizostylis* with a rhizome, and *Chasmanthe* with an annual corm comprising numerous internodes. Here then is a fifth exception.

The *Crocasmia* corm is depressed globose, ovoid or shortly ellipsoid, and up to 35–50 mm in diameter. It is usually covered with somewhat broken layers of membranous or papery tunics which are the bases of the cataphylls and basal foliage leaves. Later the intercostal areas in the upper parts of the tunics may break down, leaving coarse parallel fibres which give the older corms a partly fibrous appearance. Still later the tunics may disintegrate totally.

At the beginning of the growing season the apical bud of the corm gives rise to a shoot comprising an abbreviated underground axis of five to seven internodes with a leaf from each node. Later the abbreviated axis becomes swollen with food reserves and forms the new corm. As the older corm does not decay, the two corms are superposed (*C. masonorum*, *C. paniculata*, *C. fucata*).

Flowering does not necessarily occur each year. When it does, the apical bud on the short underground shoot gives rise to a long aerial scape with a terminal inflorescence.

Two distichous rows of axillary buds occur on the corm. Often several of these also develop further: the uppermost axillary bud, or sometimes the two highest buds, may give rise to a shoot similar to that of the apical bud (*C. masonorum*, *C. paniculata*). Or one or more of the buds form a slender underground stolon, 70–200 mm in length and 2–3 mm in diameter, from the end of which a new shoot arises at the beginning of the next growing season (*C. aurea*). In the hybrid *C. crocosmiiflora* which usually produces no viable seeds, both types of axillary bud development may take place.

As the apical bud of the corm at length produces the flowering shoot, further growth of the plant is brought about by the axillary buds. Branching is therefore sympodial, as in other Ixiodeae.

Aerial Stem (Scape)

The scape, varying in length from 300 mm to considerably more than a metre and from 3 to 9 mm in diameter, is strong and rigid. Its lower half is densely covered with long imbricate leaf sheaths. The upper half is naked except for a small number of tiny cauline leaves. It is cylindrical, with the

exception of *C. aurea* where it is 7–10-ribbed, and of the hybrid, *C. crocosmiiflora*, which has two or three ribs.

Leaves

As is characteristic for the Ixiodeae, the leaves are equitant and arranged in two distichous rows. Two to three cataphylls, five to nine basal foliage leaves and a small number of cauline leaves occur. The cataphylls are short and largely bifacial with only the tips sometimes unifacial. They wither early in the growing season. The long, erect or suberect basal foliage leaves are imbricate and crowded together on the short internodes at the base of the axis. As a new corm develops there, their bases form the corm tunics. The cauline leaves on the scape are small, the higher ones being almost bract-like and bifacial.

The basal foliage leaves have unifacial blades which are longer and often much wider than their bifacial leaf sheaths. The blades are linear-lanceolate and 5–20 mm in width (*C. aurea*, *C. pottsii*) or ensiform or narrowly elliptical and up to 80 mm wide across their broadest part, from where they taper to an acute or acuminate tip and downwards to the narrow sheath (*C. massonorum*, *C. mathewsiana*, *C. paniculata*). The blades are plane (flat) in *C. aurea*, *C. pottsii*, *C. crocosmiiflora* and *C. fucata*, and plicate in *C. massonorum*, *C. mathewsiana*, *C. paniculata* and *C. pearsei*. These plicate leaves do not have the ability to fold and expand with varying water contents.

In texture, the leaves are thin and almost papery, mechanical strength being supplied by numerous parallel fibro-vascular strands. The largest strand near the middle of the blade is the pseudo-midrib (Napp-Zinn, 1974; de Vos, 1982a). It is complex, consisting of several fibro-vascular bundles which remain distinct and are separated from one another by narrow zones of chlorenchyma and in the centre of the rib by a mass of colourless water-storing parenchyma. In *C. aurea* the pseudo-midrib is composed of one pair of large opposing bundles with a pair of smaller ones on either side. In *C. mathewsiana* and *C. paniculata* it comprises about eight pairs of large bundles and several small ones in between. Higher up the blade the side bundles of the midrib gradually diverge, thus increasing the number of primary parallel veins in the upper half of the blade. In *C. aurea* and *C. pottsii* the pseudo-midrib (termed middle vein in the systematic section of this article) extends to the leaf tip. In species with plicate leaves on the other hand, this vein is hardly distinguishable from the lateral primary veins in the upper half of the blade.

Leaf anatomy

As is usual in unifacial leaves, all veins have outward facing phloem and inward facing xylem, and a larger or smaller bundle of parenchyma between

phloem and epidermis (de Vos, 1982a). The veins are arranged in pairs in which the two opposing xylem bundles may fuse or remain distinct. In plane leaves the two opposing bundles of each pair are almost equal in size. In plicate leaves they differ in size, the larger bundle of the pair, with a massive strand of sclerenchyma, occurring in the convex angle of each fold and the smaller bundle in the concave angle (Fig. 6b). This latter bundle is often hardly visible externally.

The leaf margins are strengthened by the epidermis only, as in most species of *Tritonia* (de Vos, 1982a). The marginal epidermal cells are small and very narrow and have their anticlinal cell walls thickened to such a degree that the cell lumina are almost obliterated.

Inflorescence

Terminating the scape is a large, laxly branched panicle or sometimes, in young specimens and in *C. aurea* var. *pauciflora*, a simple spike. The panicle usually has from one to five distichously arranged primary and sometimes secondary branches, each subtended by a small narrow bract. The branches, (20–)100–200(–250) mm in length, are more or less straight or curved and flexuose (*C. mathewsiana*) or zigzag (*C. paniculata*). They are ascending in *C. pottsii*, ascending and then spreading and somewhat flexuose in *C. mathewsiana*, and spreading almost at right angles in *C. paniculata*. In *C. masonorum* the main axis is horizontally curved.

The flowers, about six to more than twenty to a branch, are sessile and are subtended by two small spathe valves (bracts) which are largely membranous, almost triangular to shortly elliptical or ovate, often somewhat spreading when drying out, and usually reddish-brown or yellow-brown. The outer bract is acute or obtuse and apiculate, and the inner shortly bidentate and 2-veined. The flowers develop distichously but later often become almost secund, e.g. in *C. mathewsiana*, *C. masonorum* and *C. paniculata*.

Flowers

In most species the flowers are funnel-shaped and zygomorphic, the degree of zygomorphy varying from slight in *C. pottsii* and *C. mathewsiana* to strong in *C. paniculata*, *C. pearsei* and *C. fucata*. In *C. aurea* however, the flowers are almost regular and more or less salver-shaped with widely spreading perianth segments which later become recurved from their bases.

The perianth tube is narrow and tubular in the lower part and usually widens gradually to the mouth which is 4–10 mm in diameter. In *C. aurea* it hardly widens at all. In *C. paniculata* and *C. fucata* the mouth is oblique, with the posticous perianth segment arising 3–5 mm beyond the anticous segment. The perianth tube is slightly shorter than the segments (*C. aurea*),

subequal to (*C. masonorum*), or up to more than twice the length of the segments (*C. paniculata*, *C. fucata*).

The segments are obtuse and usually elliptical (*C. aurea*) or somewhat lanceolate (*C. pottsii*). In *C. aurea* they are almost equal. In other species the median posticous segment is largest and erect (porrect), often arched or slightly concave, thus protecting the anthers. The other five segments are spreading and usually vary only slightly in size, with the three outer segments often slightly smaller than those of the inner whorl. No vestiges of calli occur.

The stamens are inserted in the perianth tube where it widens. In *C. aurea* they are widely exserted and central, whereas in *C. masonorum* they are also widely exserted but inclined towards the posticous side of the flower. In other species, such as *C. pottsii* and *C. mathewsiana*, only the anthers are exserted. Here the anthers are contiguous and inclined towards the posticous segment, facing the anticous side of the flower and dehiscing towards this side. The anthers are linear and versatile, attached about one-third from the base. Below the point of attachment they are bifid.

Nectaries are septal and nectar rises into the perianth tube. Pollination is probably by sunbirds and long-tongued insects.

Except for the length of the style and style branches, the pistil is of little value for distinguishing the species. The trilocular ovary has eight to fourteen ovules in the lower half of each chamber. It is shortly ellipsoid and 3–4(–9) mm long. The long slender style has short style branches which often overtop the anthers. In zygomorphic species the style is usually curved towards the posticous perianth segment. The stigmas are terminal, slightly widened or very shortly bifid and shortly fimbriate.

Capsules

In the capsules important differences between *Crocasmia* and *Tritonia* are to be found. In *Crocasmia* they are hard and somewhat woody, much broader than long, very deeply 3-lobed and often also nodose. Only one or two, or sometimes three or four seeds develop per locule. These are larger than in *Tritonia* and the seed-coat is thicker on account of a broad outer integument which has a thick layer of large, thin-walled water-holding parenchyma cells under its epidermis. These cells later break down when the seeds become dehydrated and the outer epidermal layer, which is smooth and glossy, becomes loose and can easily be rubbed off. This is in contrast to the seed-coats of *Tritonia* and *Chasmanthe*. (See Table 1.) At length the seeds of *Crocasmia* are dull, wrinkled and angled.

Chromosomes

Goldblatt (1971) examined the karyotypes of four species of *Crocasmia*,

namely *C. aurea*, *C. pottsii*, *C. masonorum* and *C. paniculata*, and of the hybrid *C. crocosmiiflora*. (A voucher specimen, Goldblatt 417 in BOL named *C. mathewsiana*, turned out to be another *C. paniculata*.) He found the diploid chromosome number for all to be 22. This confirmed the counts previously made by other workers for *C. aurea*, *C. pottsii*, and the hybrid (see Goldblatt, 1971). The chromosomes are small, ranging from under 2 μm to just less than 3 μm . He recognised six pairs of somewhat larger chromosomes; two of these were metacentric in *C. aurea*, *C. pottsii* and the hybrid. He found the karyotype of *C. paniculata* to be very similar to that of other *Crocoshmia* species. This suggested to him that this species, till then placed in its own monotypic genus *Crotonus*, was indeed a species of *Crocoshmia* with a longer perianth tube and a strongly zygomorphic flower.

After the discovery of fresh material of *C. fucata* in 1983 on the Kamiesberg in Namaqualand, the chromosomes of this species could now also be examined. Here I found a diploid complement of 22 chromosomes, in contrast to the 20 chromosomes Goldblatt recorded (1971) for two species of *Chasmanthe*. As the morphological characters of *C. fucata* also indicate a close relationship with *C. paniculata*, there can be no doubt that this species should be transferred from *Chasmanthe* to *Crocoshmia*, notwithstanding its isolated habitat far from other species of *Crocoshmia*. See under *C. fucata*.

GEOGRAPHY and ECOLOGY (Figs 1, 2)

Crocoshmia species are widespread in the inland summer rainfall regions of the eastern parts of southern and central Africa, from the equator southwards into the eastern parts of the Republic of South Africa (perhaps also north of the equator?). The species with the widest range is *C. aurea* which has been found in Tanzania, Zaire, eastern Angola, eastern Zimbabwe, Mocimboa, Swaziland, Lesotho, and in the eastern parts of all four South African provinces, as well as in the southern Cape district of George where the type specimens were collected. There is a slight possibility that here the species might have been a garden escape.

Two more species also have a wide range: the high altitude species *C. paniculata* occurs on the Drakensberg range in northern Lesotho, north eastern Orange Free State and eastern Transvaal, and on mountains of Swaziland and eastern Zimbabwe; *C. pottsii* is found at lower altitudes spread over Natal and also in the Transkei.

The following are local endemics occupying very small areas: *C. masonorum* in one district of the Transkei; *C. pearsei* on the Natal Drakensberg; *C. mathewsiana* in a small area of about 50 km on the Drakensberg escarpment of the eastern Transvaal; and *C. fucata* in kloofs of the Kamiesberg in Namaqualand. The latter is the only species of *Crocoshmia* found in the western parts of South Africa.

The locality of *C. latifolia*, described from specimens that were grown in the Royal Botanic Gardens at Kew, is not known, and *C. cinnabarina*, described from an immature specimen, was found only once in eastern Angola. The hybrid *C. crocosmiiflora* is grown world-wide and has become a garden escape in many areas.

Crocoshmia species prefer moist habitats such as damp shady places (*C. mathewsiana*), moist vleis (*C. paniculata*), stream banks (*C. aurea*, *C. pottsii*, *C. fucata*), and wooded kloofs and forest margins (*C. aurea*, *C. mathewsiana*).

Most are social, growing in groups or large clumps. An exception is *C. pearsei* which has up until now been found as solitary plants (Obermeyer, 1981). When growing under optimum conditions they may retain their leaves for most of the year. Otherwise their shoots die down in winter and

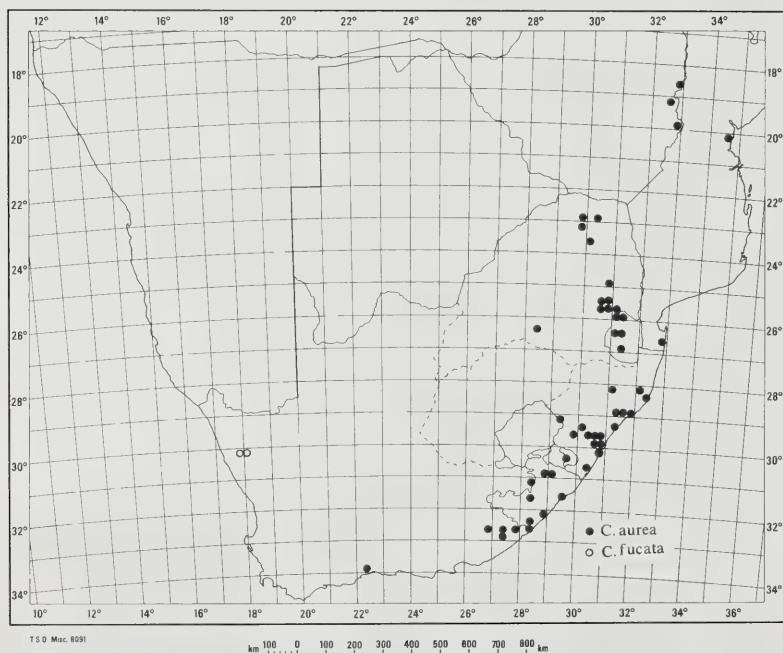


FIG. 1
Geographical distribution in southern Africa, of *Crocoshmia aurea* and of *C. fucata*.

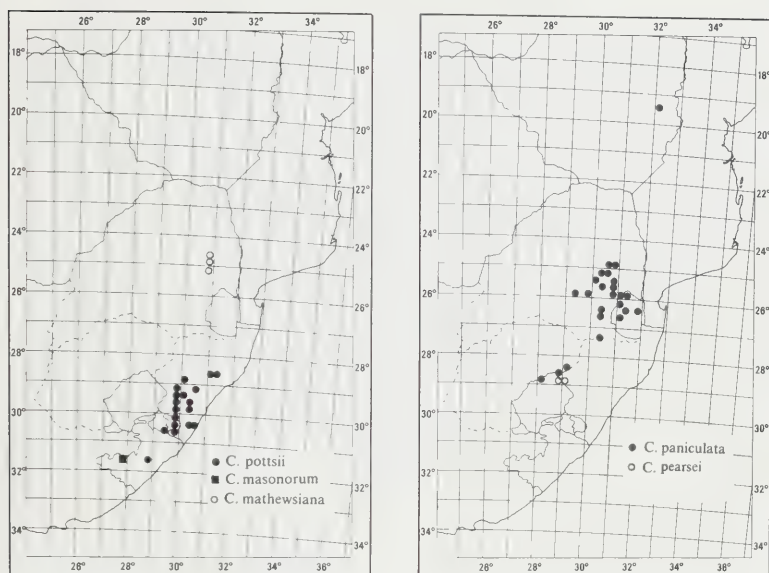


FIG. 2

Geographical distribution of *Crocoshmia masonorum*, *C. mathewsiana*, *C. pottsii*, *C. paniculata*, and *C. pearsei*.

new shoots develop when conditions such as extreme cold or severe drought abate. Flowering is in summer, from November (*C. fucata*) or December (*C. masonorum*) to April (*C. aurea*).

HISTORICAL

Before 1850 only a single species of *Crocoshmia* was known in England and Europe. Specimens collected by "Mr Villett" in the George district as well as a drawing made by him (probably C. J. Villet, flower painter and dealer in natural history material) were sent to Kew in about 1845 by the Cape botanist and physician, Dr. C. W. L. Pappe, as *Tritonia aurea*. This name was published by W. J. Hooker in *Curtis's Botanical Magazine* of 1847. The accompanying figure, t. 4335, is probably that of Villet which accompanied the material.

A few years later the French botanist, J. E. Planchon, convinced that the species did not fit well into *Tritonia*, described a new genus, *Crocoshmia*, to accommodate it (1851–52). He stated that this name referred to the fact that dried flowers of the species, when infused in hot water, emitted a very pronounced odour of saffron (*Crocus*). He was uncertain whether the odour came from the stigmas, as in saffron, or from the perianth, and whether fresh flowers also had this smell (this they do not have).

At first only Klatt (1863) accepted the genus (as *Crocoshma*). Baker (1877) transferred it to *Tritonia* as section *Crocoshma*; Klatt followed suit in 1882 and so did Pax in 1888. It was only after Bentham and Hooker (1883) had reinstated it, as *Crocoshma*, that it became more generally accepted, e.g. by Baker (1892, 1896, 1898), Klatt (1895), Diels (1931), and by N. E. Brown (1932) who redefined the genus and placed another four species in it.

The difference of opinion on the status of *Crocoshmia* again came to the fore when Phillips (1951) reduced it to the synonymy of *Tritonia*. Although Goldblatt treated it as genus in 1971 and again in 1976, he admitted in 1971 (p. 425) that "our knowledge is not yet complete enough to decide whether *Crocoshmia* is a valid genus or not". He treated it as genus for the sake of convenience.

Up to 1932 *Crocoshmia* had remained a monotypic genus. At that time Brown transferred two species (*Tritonia masonorum* and *T. pottsii*) and the hybrid between the latter and *C. aurea*, to it. He also described a new species *C. latifolia* and raised the rank of a variety to that of species (*C. maculata*), thus widening the circumscription of the genus to accommodate species with zygomorphic, funnel-shaped flowers with included filaments and contiguous, unilateral anthers.

C. paniculata was first described as *Antholyza paniculata* Klatt (1865). In 1932 Brown established the monotypic genus *Curtonus* for it when he revised the large and heterogeneous genus *Antholyza*. Goldblatt (1971) found the karyotype of this species to be very similar to that of species of *Crocoshmia* and transferred the species to the latter genus, as its morphological features also indicated such a relationship.

Further work on *Crocoshmia*, after 1932, was fragmentary. Two more species were transferred from *Tritonia* to *Crocoshmia*, namely *T. cinnabarina* transferred by de Vos in 1983, and *T. mathewsiana* regarded as a *Crocoshmia* by Goldblatt (1971). Only two new species were described: *C. pauciflora* by Milne-Redhead in 1948—this is so closely related to *C. aurea* that it is now placed with the latter species as a variety—and *C. pearsei* by Obermeyer in 1981, a species very closely related to *C. paniculata*. Another, originally described as *Tritonia fucata*, has long been regarded as closely related to *C. paniculata* and is now also placed with *Crocoshmia*, notwithstanding its very different habitat in the north western Cape Province.

RELATIONSHIPS and ORIGIN

Crocasmia is closely related to both *Tritonia* and *Chasmanthe*, the latter being one of the genera that Brown (1932) established for some of the species which he excluded from *Antholyza*. Most authors recognised the relationship between *Tritonia* and *Crocasmia* but it was Lewis (1954) who first realised this three-sided relationship. In her phylogenetic scheme (p. 102) she placed *Chasmanthe* at the end of a branch emanating from *Crocasmia*, and *Tritonia* on a separate neighbouring branch, both branches extending from the same hypothetical ancestral source. This means that she regarded *Crocasmia* as standing closer to *Chasmanthe* than to *Tritonia*.

Goldblatt's cytological studies on the Iridaceae (1971) led him to confirm this close relationship of the three genera. He grouped them in subtribe Tritoniineae, together with *Montbretia* which was later included with *Tritonia* (Goldblatt, 1974; de Vos, 1983) and the central African genus *Zygotritonia*, the chromosomes of which he did not investigate.

The present investigation, as well as recent work on *Tritonia* (de Vos 1982b, 1983) and my preliminary work on *Chasmanthe*, confirms the above-mentioned views. I cannot agree with Hutchinson (1959) who placed *Chasmanthe* (as part of *Petamenes*) in the tribe Antholyzeae and *Crocasmia* and *Tritonia* in tribe Gladioleae. Like Lewis (1954) I believe that *Crocasmia* stands closer to *Chasmanthe* than it does to *Tritonia*, as it differs in more respects from the latter than from the former (Table 1).

Considerable specialisation has taken place within each genus and, as each shows both primitive and advanced characters, it is hardly possible to decide which of the three genera is most primitive. The large several-noded, persistent corm of *Crocasmia* can be taken as primitive as it stands nearer the ancestral rhizome of the Ixioidae (cf. Lewis, 1954). On the other hand, the short, few-seeded capsules and seeds with a water-holding testa of *Crocasmia* are specialised, probably for dispersal by birds.

If the distribution of the three genera is considered, *Crocasmia* can again be regarded as the most primitive (see also Goldblatt, 1971), it being mainly a montane genus from the eastern parts of central and southern Africa, adapted to summer rainfall conditions. *Tritonia*, ranging from the eastern parts of southern Africa, through the southern districts where most species occur, into the south western and western winter rainfall areas and into the arid Karoo region, has become adapted to annual dry periods. The small genus *Chasmanthe* is mainly restricted to winter rainfall areas of the southern and western Cape Province and it is also adapted to withstand the hot dry summers that prevail there.

According to chromosome numbers *Chasmanthe* is advanced, with its basic chromosome number of $n = 10$ which probably originated from $n = 11$ of *Tritonia* and *Crocasmia*, through aneuploid reduction (Goldblatt, 1971).

It would probably be best to place each genus at the end of a separate phylogenetic line, all three extending from a common ancestral form. Possibly *Crocoshmia* and *Chasmanthe* were at first on the same line that split at a later date.

TABLE 1
Differences between *Crocoshmia*, *Tritonia* and *Chasmanthe*

	<i>Crocoshmia</i>	<i>Tritonia</i>	<i>Chasmanthe</i>
Corm	Persistent; numerous internodes	Annual; few internodes	Annual; numerous internodes
Corm axillary buds	Numerous in 2 rows	Few	Few
Pseudo-midrib of leaf comprises	Several pairs of large veins	One pair of large veins	Several pairs of large veins
Anthers bifid	In lower third	In lower third or quarter	In lower half
Height of anthers in flower	Equally high	Equally high	One anther higher than other two
Stigmas	Small, terminal	Elongated	Small, terminal
Capsules	Depressed globose, 3-lobed, hard, somewhat woody	Elongated, ellipsoid to obovoid, 3-angled	Shortly ellipsoid, 3-lobed, hard, somewhat woody
Seeds per chamber	1-3(-4)	Numerous	Few
Seed-coat	Thick, outer layers becoming loose	Thin, outer layers persistent	Thick, outer layers persistent
Chromosome number	$2n = 22$	$2n = 22$	$2n = 20$

TAXONOMIC TREATMENT

Crocoshmia Planch. in Fl. des Serres 7: 161 & t. 702 (1851-52); Klatt in Linnaea 32: 764 (1863) & in Dur. & Schinz, Consp. Fl. Afr. 5: 203 (1895), as *Crocoshma*; Bentham & Hooker, Gen. Pl. 3: 707 (1883), as *Crocoshma*; Bak. Handb. Irid. 189 (1892), as *Crocoshma*, & in Fl. Cap. 6: 129 (1896) & in Fl. Trop. Afr. 7: 355 (1898); Diels in Nat. Pflanzenfam. ed. 2, 15a: 491 (1931); N. E. Br. in Trans. Roy. Soc. S. Afr. 20: 264 (1932); Goldbl. in Jl S. Afr. Bot. 37: 420 (1971) & in Dyer, Gen. S. Afr. Flow. Pl. 2: 973 (1976); Compton in Jl S. Afr. Bot. Suppl. Vol. 11: 140 (1976). Type species: *C. aurea* (Pappe ex Hook.) Planch.

Tritonia Ker-Gawl. sensu Hook. in Curtis's Bot. Mag. **73** t. 4335 (1847); E. P. Phill. Gen. S. Afr. Flow. Pl. ed. 2, **219** (1951), partly.

Tritonia Ker.-Gawl. sect. *Crocoshia* (Planch.) Bak. in J. Linn. Soc. **16**: 163 (1877); Klatt in Abh. Naturf. Ges. Halle **15**: 358 (1882); Pax in Nat. Pflanzenfam. **2** (5): 15 (1888).

Crocoshia Klotzsch ex Klatt in Peter's Reise Mossamb. Bot. **2**: 516 (1863). Type species: *C. mossambicensis* Klotzsch ex Klatt.

Curtonus N. E. Br. in Trans. Roy. S. Afr. **20**: 270 (1932); E. P. Phill. Gen. S. Afr. Flow. Pl. ed. 2, **221** (1951); Goldbl. in Jl S. Afr. Bot. **37**: 420 (1971). Type species: *C. paniculatus* (Klatt) N. E. Br.

Geophytes of medium height or up to more than a metre tall, mostly deciduous. *Corms* persistent, medium to large, depressed globose to shortly ovoid or ellipsoid, often superposed in rows of 2–4 or connected by long slender stolons; tunics membranous, later often fibrous or disintegrating. *Scape* erect, strong, cylindric or sometimes ribbed, the lower half covered with imbricate leaf sheaths. *Basal leaves* several, large, equitant-unifacial, linear-lanceolate to elliptic-ensiform and tapering to an acuminate tip and to a narrow base, plane or plicate, glabrous, usually with several primary veins; cauline leaves few, small, largely bifacial. *Inflorescence* a large, laxly branched panicle, each branch with few to numerous distichous or secund flowers, or sometimes a simple spike. *Bracts* small, membranous to subherbaceous, shorter than the perianth tube; *outer* acute or obtuse and apiculate; *inner* bidentate, 2-veined, subequal to the outer. *Flowers* zygomorphic to almost regular, funnel-shaped or salver-shaped, bright orange-yellow to brick-red. *Perianth tube* tubular or funnel-shaped, widening gradually, often slightly curved, sometimes with an oblique mouth; *segments* usually elliptical, obtuse, almost equal and spreading or recurved, to very unequal with the posticous segment largest and porrect and other segments spreading. *Stamens* inclined towards the posticous segment or sometimes central and exserted; *anthers* linear, versatile, bifid from the base for one-third of its length, often contiguous and unilateral. *Ovary* 3-chambered, shortly ellipsoid, with 8–14 ovules per chamber; *style* long, filiform, with three short spreading branches; *stigmas* three, terminal, small, slightly cuneate or minutely bifid. *Capsules* depressed globose-trigonous, broader than long, rather woody; *seeds* 1–2(–4) per chamber, globose or angled, testa at first smooth, later wrinkled. *Chromosome number* $2n=22$ (Goldblatt, 1971).

The genus could perhaps be divided into two sections, with *C. aurea* with its almost regular flowers in one section and the other species which all have zygomorphic flowers in another section. As the genus is so small, and as hy-

brids have often been obtained between *C. aurea* and *C. pottsii* which would belong to the first and second sections respectively, a division into sections has been omitted.

KEY TO THE SPECIES

1. Perianth tube less than twice the length of the segments:
 2. Leaves usually up to 20 mm wide, rarely to 30 mm, plane, linear-lanceolate, with numerous closely spaced slender veins and a prominent vein up to the leaf tip:
 3. Flowers zygomorphic, perianth tube widely funnel-shaped; filaments 8–12 mm long 4. *C. pottsii*
 3. Flowers almost regular or only slightly zygomorphic; perianth tube largely tubular, widening only slightly; filaments 15–40 mm:
 4. Perianth almost regular, salver-shaped with horizontally spreading or recurved segments; stamens and style widely exerted, more or less central; peduncle 7–10-ribbed 1. *C. aurea*
 4. Perianth slightly zygomorphic, funnel-shaped, with spreading segments; stamens and style somewhat exerted, placed slightly towards the posticous segment; peduncle 2–3-ribbed 9. *C. crocosmiiflora*
 2. Leaves usually more than 30 mm wide, narrowly elliptical, plicate, tapering to an almost stalk-like base, with numerous prominent widely spaced veins and a vein prominent in the lower part of the leaf near the middle:
 5. Inflorescence a horizontally curved spike with flowers second on the upper side, rarely with 1–2 branches 3. *C. masonorum*
 5. Inflorescence a large laxly branched panicle with distichous or second flowers:
 6. Flowers distichous, almost salver-shaped, with widely exerted stamens and style 2. *C. latifolia*
 6. Flowers second, funnel-shaped, with only the anthers and style branches exerted 5. *C. mathewsiana*
1. Perianth tube at least twice the length of the segments:
 7. Panicle with ascending branches, rarely a spike; perianth tube widely funnel-shaped; filaments 8–12 mm long 4. *C. pottsii*
 7. Panicle with almost horizontal branches, sometimes a spike; perianth tubular in the lower half, funnel-shaped in the upper; filaments 25–40(–50) mm long:
 8. Leaves plicate; panicle or few-branched spike; Drakensberg range:
 9. Branches of panicle strongly zigzag in their upper part; flowers up to 75 mm long; plants in large clumps 6. *C. paniculata*
 9. Branches of spike straight or faintly zigzag; flowers 70–90 mm long; plants solitary 7. *C. pearsei*
 8. Leaves plane; usually a spike, often with 1–2 branches; Kamiesberg range 8. *C. fucata*

1. *Crocoshmia aurea* (Pappe ex Hook.) Planch. Fl. Serres Ser. 1 (7): 161 & t. 702 (1851–52).

Plants (450–)600–1 000(–1 300) mm high. *Corms* depressed globose or shortly ovoid, (10–)15–20 mm diam., connected by underground stolons up

to 180 mm long; tunics membranous, almost papery, brown. *Scape* (450-)600-1 000(-1 300) mm long, erect or suberect, rigid, 7-10-ribbed. *Basal leaves* several, plane, linear-lanceolate, (200-)400-600(-1 200) × (8-)10-20(-30) mm, tapering to an acute or acuminate tip and downwards to the narrow sheath, with a strong middle vein, thin-textured with a slight silky sheen when dry; *cauline leaves* smaller, upper ones bract-like. *Inflorescence* a rather lax, often slightly flexuose panicle 100-200(-300) mm long, rarely a simple spike (var. *pauciflora*), with several ascending-spreading, often slightly wavy branches 20-60 mm long, with (3-)5-10 flowers to a branch. *Bracts* subherbaceous, orange-brown to orange-yellow, almost triangular, (4-)7-10(-15) mm long, tips usually slightly spreading; *outer* acute or acuminate or 2-3-toothed; *inner* bidentate with acuminate teeth, 2-veined and 2-keeled in upper part. *Flowers* regular, salver-shaped, (20-)35-50(-65) mm long, bright golden-orange or reddish-orange (RHS 23A, 28A, 30A). *Perianth tube* tubular, curved, (10-)20-27 mm long, hardly widened upwards, bright orange, shorter than the segments; *segments* subequal, narrowly elliptical, obtuse, spreading horizontally, later strongly recurved from the base, (12-)25-35(-40) × (4-)6-10 mm, outer often eared at the base, inner sometimes with inrolled margins near the base, rarely with a large dark blotch near the base. *Stamens* well exerted, placed centrally; *filaments* (15-)25-35(-40) mm, pale yellow; *anthers* (3-)6-10 mm long, orange, pollen orange. *Style* well exerted, almost central, (22-)35-45(-60) mm, yellow, branches 4-8 mm, orange; *stigmas* at or above the anther tips. *Capsules* depressed globose-3-lobed, nodose, reddish-orange, later deeply 3-lobed, 12-15 mm diam., much wider than long; *seeds* 1-2(-4) per locule, at first globose, blue-black, glossy, 4-6 mm diam., later wrinkled and angled. *Chromosome number* $2n = 22$ (Goldblatt, 1971, for var. *aurea*).

Flowering period: (December to) February to March (to April) and to June in Malawi.

Distribution: widely distributed in the eastern parts of southern and central Africa, in moist places such as forest margins, wooded kloofs, south-facing slopes and along river banks. Fig. 1.

This very distinct species of *Crocoshmia* is distinguished by its almost regular, star-like, intensely coloured flowers with spreading and later often recurved perianth segments which are somewhat longer than the slightly curved tubed, and by long, well-exserted and more or less centrally placed stamens and style. The golden-orange colouration of the flowers is usually well preserved in herbarium specimens. The leaves are rather soft and thin-textured and have in herbarium specimens an almost papery texture with a silky sheen. This readily distinguishes the species from its nearest relation, the hybrid *C. crocosmiiflora*.



FIG. 3

Crocosmia aurea a, panicle, diagrammatic; b, peduncle in transverse section; c, flower, side view and median section; d, anther, style branches and stigmas; e, outer (left) and inner (right) bract; f, capsules; g, corm with tunics (left) and with tunics removed (right); n, nodes; s, scale leaf on stolon. (de Vos 2449)

Specimens collected by a Mr Villet in the southern Cape district of George were sent to Kew by Dr Pappe of Cape Town, together with Villet's coloured drawing, and were described by W. J. Hooker (1847).

Two taxa, previously described as separate species, are now incorporated with *C. aurea* as varieties. The one, *pauciflora*, differs only in its fewer and smaller flowers, and the other in the perianth with dark blotches in the throat.

KEY TO THE VARIETIES

1. Inflorescence a compound, many-flowered panicle; flowers longer than 35 mm, rarely only 30 mm; style longer than 30 mm:
 2. Flowers without dark blotches a. var. **aurea**
 2. Flowers with a dark blotch near the base on the inner perianth segments b. var. **maculata**
1. Inflorescence a simple, few-flowered spike; flowers 20–30 mm long, rarely to 35 mm; style 22–27 mm c. var. **pauciflora**

a. var. **aurea**

Crocosmia aurea (Pappe ex Hook.) Planch. Fl. Serres, Ser. 1 (7): 161 & t. 702 (1851–52); Klatt in Linnaea 32: 764 (1863) & in Dur. & Schinz, Conspect. Fl. Afr. 5: 203 (1895), as *Crocosma*; Bak., Handb. Irid., 189 (1892) as *Crocosma* & in Fl. Cap. 6: 129 (1896) & in Fl. Trop. Afr. 7: 355 (1898); Diels in Nat. Pflanzenfam., ed. 2, 15a: 491 (1931); Compton, J. S. Afr. Bot. Suppl. 11: 140 (1976).

Tritonia aurea Pappe ex Hook. in Curtis's bot. Mag. 73 t. 4335 (1847); Bak. in J. Linn. Soc. 16: 163 (1877); Klatt in Abh. Naturf. Ges. Halle 15: 358 (1882). Type: Cape, George, *Pappe s.n.* (in Herb. Hooker, K, holo.-; *Pappe* SAM 21194 (SAM, iso.-?))

Crocantus mossambicensis Klotzsch ex Klatt, in Peters, Reise Mosamb. Bot. 2: 516 (1863). Type: not seen.

Babiana aurea Klotzsch in Allg. Gartenz. 293 (1851) – f. Morren in Belg. Hort. p. 299 (1881). Type: not seen.

Icones: Curtis's bot. Mag. t. 4335; Fl. Serres Ser. 1 (7) t. 702; Bot. Reg. 33 t. 61; Letty, Wild Flowers of Transvaal Pl. 37/2; Trauseld, Wild Flowers of Natal Drakensberg p. 44; this work Fig. 3.

Plants 500 mm or higher. *Inflorescence* a many-flowered lax panicle with upward spreading, slightly wavy branches. *Bracts* (5–)7–10(–15) mm long. *Flowers* (30–)50–65 mm long. *Perianth tube* (15–)20–27 mm long. *Filaments* (20–)25–35 mm. *Style* 30–45(–60) mm.

TRANSVAAL—2229 (Waterpoort): Soutpansberg 6 km W of main road (–DD), Rodin 4026 (PRE, K); Hangklip. *Gerstner* 5904 (PRE); NE of Louis Trichardt. Tölken 1200 (SRGH).
—2230 (Messina): Sibasa (–CD), Hemm 536 (PRE, MO).

- 2329 (Pietersburg): Louis Trichardt distr. (-BB), *Koker* 25 (PRE), *Rodin* 4026 (MO).
- 2330 (Tzaneen): Farm Vreedsaam, Mooketsi Valley (-CA), *Killick & de Winter* 8926 (PRE); Duiwelskloof, Letaba, *Scheepers* 619 (PRE); Westfalia Estate, *Bos* 1343 (STE, K).
- 2430 (Pilgrim's Rest): Near Graskop (-DD), *Van der Merwe* 331 (NBG, PRE); Kowyns Pass, *Kluge* 1686 (PRE).
- 2530 (Lydenburg): Wonderboom Nature Reserve (-BC), *Elan-Puttick* 325 (PRE); Witkop-plantasie (-BD), *Kluge* 486 (PRE); Starvation Creek Nature Reserve (-DA), *Kluge* 1247 (PRE).
- 2531 (Komatipoort): Mt Sheba (-CA), *Jones & Leach* 19 (PRE); Around Barberton (-CC), *Galpin* 805 (BOL, GRA, K); Near Rimer's Creek, Barberton, *Balsinhas* 3152 (PRE); Havelock, *Bayliss* 2739 (NBG).
- 2628 (Johannesburg): Heidelberg (-AD), *Bonsma* 8189 (PRE).
- NATAL—2831 (Nkandla): Shongweni Dam (-AA), *Morris* 797 (NU); Eshowe (-CD), *Lawn* 190 (NH); Mtunzini distr. (-DC), *Wells & Edwards* 104 (NU); Umlalazi Nature Reserve (-DD), *Ward* 4597 (NH).
- 2832 (Mtubatuba): Hluhluwe Game Reserve (-AA), *Ward* 3062 (NH, NU); Game Park St Lucia Estuary (-AD), *Posley s.n.* (NU).
- 2929 (Underberg): Cathkin Park, Drakensberg (-AB), *Howlett* 111 (NH); Giants Castle Game Reserve, *Trauseld* 338 (NU); Deepdale (-DB), *Evans* 87, 216 (NH).
- 2930 (Pietermaritzburg): Karkloof, Lions River (-AC), *Moll* 3441 (NH); Inchanga Hill (-DA), *Burt & Hilliard* 3799 (NU); Ismont Mt. (-DC), *Strey* 8365 (NH); Crestholme, Hillcrest (-DD), *Coleman* 76 (NH); Pinetown, *Drummond* NH 67252 (NH).
- 2931 (Stanger): Kearnsey (-AD), *Milner* NH 23452 (NH); Wentworth, Durban distr., *Ward* 6124 (NH, NU).
- 3030 (Port Shepstone): Umbogintwine (-BB), *Forbes* 1215 (NH).
- CAPE—3028 (Matatiele): Mount Frere (-DD), *Acocks* 12551 (PRE).
- 3029 (Kokstad): Insizwa forest floor (-CC), *Strey* 10785 (NH, NU, MO, PRE); Zuurberg nr Kokstad (-BC), *Tyson* 1701 (GRA, SAM).
- 3128 (Umtata): Maclear (-AB), *Martinson* NBG 447/28 (NBG); Baziya (-CB), *Baur s.n.* (GRA), BOL 3203 (BOL), *Thode* 5315 (STE), *Baur* 31 (SAM, K), *Flanagan* 267 (GRA), *Mauve* 4865 (PRE).
- 3129 (Port St Johns): Port St Johns (-DA), *Howlett* 32 (PRE), *Galpin* 11443 (PRE).
- 3226 (Fort Beaufort): Hogsback Forest Res. above Alice (-DB), *Dahlstrand* 2927 (PRE).
- 3227 (Stutterheim): Dohne (-CB), *Sim* 19884 (PRE); Izeleni, *Sim* 19921 (PRE); 18 mls from Stutterheim towards Grahamstown (-CD), *Van Breda* 858 (PRE); Komga (-DB), *MacOwan* 1543 (SAM), *Flanagan s.n.* (SAM 21196).
- 3228 (Butterworth): Willowvale, Dunessa Forest (-AD), *Wood* 165 (NH, NU); The Haven, Elliotdale distr. (-BB), *Gordon-Gray* 468 (NU); Kentani distr. (-CB), *Pegler* 339 (NU), NBG 239/13 (BOL).
- 3322 (Oudtshoorn): George (-CD), *Pappe s.n.* (K), *Pappe s.n.* (SAM 21194); Vlei near George, *Viviers* 130 (STE).

Without precise locality: Tembuland, *Marloth* 8044 (PRE).

TANZANIA: Distr. Lindi, Mucra Plateau, *Schlieben* 5981 (SRGH); 61 mls S of Iringa, *Pollhill & Paulo* 1713 (K, SRGH); Ukaguru Mts., Kilosa distr., *Thulin & Mhoro* 2764 (K); Lupembe Hills, Matenga, *Milne-Redhead & Taylor* 9011 (K); Near Msalanga, *Bally* 7922 (K); Lushoto distr., *Drummond & Hemsley* 3178 (K); Morogoro, *Schlieben* 3201 (MO).

ZAMBIA: North Western Province, Mwinilunga distr., *Brummitt e.a.* 14013 (SRGH).

MALAWI—1033 Nyika Plateau (-DB), *Brummitt* 10889 (SRGH); Juniper Forest, *Salubeni* 3053 (MO).

—1133 Mzimba distr., Vipya, *Pawek* 1784 (K).

—1134 Nkhata Bay, Mzuzu (CA-CB), *Pawek* 5312 (SRGH), 8322 (MO).

—1234 Kotakota, *Jackson* 1103 (K).

—1535 Zomba Plateau (-AD), *Brummitt* 9127 (K).

—1735 Port Herold (-AA), *Phipps* 2629 (SRGH).

ZIMBABWE—1832 (Umtali): Honde Valley nr Ruda River (-DB), *Plowes* 2080 (SRGH).

—1932 (Melsester): Stapleton near Meikle Forest Station (-BA), *Müller* 2981 (SRGH); Vumba, *Chase* 5488 (SRGH); Melsester (-DD), *Crook* 455 (SRGH), *Hall* 424 (SRGH), *Chase* 4841 (MO).

MOCAMBIQUE—2034 (Nova Sofala): Manica e Sofala (-BA), *Exell* *e.a.* 319 (SRGH), *Müller* 1154 (K); Chimanimani Mts., *Hall* 424 (BOL).

—2632 (Bela Vista): Lourenco Marques (-DC), *Gomes e Sousa* 5055 (PRE).

SWAZILAND—2531 (Komatipoort): Piggs Peak (-CC), *Bayliss* 5619 (C, MO).

—2631 (Mbabane): Ukutula, *Compton* 2567 (NBG); Hill NW of Mbabane (-AC), *Dlamine* (NBG); Mdimba (-AD), *Kemp* 683 (MO); Hlatikulu (-CD), *Stewart* 92 (K), 9349 (SAM).

The flowers of the holotype in Hooker's herbarium in Kew have retained their bright orange-yellow colouring for almost 140 years. A Pappe specimen in the Compton Herbarium in Kirstenbosch (SAM 21194) labelled "In provincia George" is identical with the holotype and can probably be regarded as an isotype.

The species does very well in gardens and was probably widely cultivated in England and Europe after its introduction in the nineteenth century. Hooker (1847) considered it to be the most beautiful of all *Tritonias* and Diels (1931) called it "geliebte Zierpflanze". Horticulturalists in South Africa know it as "Falling Stars". In regions with suitable climates it can possibly escape from gardens into the wild, especially as the seeds are distributed by birds. For example, the specimen *Morton* K855 in Kew, from Mann's Springs, Cameroon Mts., British Cameroons, has a note on its label, "A relict of cultivation". The type locality, which is George in the southern Cape Province, is almost 500 km distant from its other habitats, and a question that cannot now be answered is whether the George specimens are perhaps garden escapes. The species still occurs near George where it was found again in 1982 (*Viviers* 130 in STE).

The capsules dehisce widely, exposing the blue-black glossy seeds (1 to 3 or rarely 4 per locule). These remain in position until disturbed by birds. The outer integument of the testa has an inner layer of large, thin-walled cells that store water. Later the thin cell walls of this layer break down and the glossy outer layer of the testa is sloughed off, leaving the seeds with a dull, shrivelled surface.

b. var. **maculata** Bak. in Gard. Chron. 4: 407 & 565 & Fig. 80 (1888) & Handb. Irid. 189 (1892) & in Fl. Cap. 6: 129 (1896). Type: locality unknown; from the garden of Mr O'Brien, Sept. 1888 (K, holo.).

Crocoshia maculata (Bak.) N. E. Br. in Trans. Roy. Soc. S. Afr. 20: 264 (1932).

Characters as in var. *aurea* except for the following: *inner perianth segments* each with a red-brown blotch above a claw-like base.

Distribution uncertain. The following specimens may perhaps represent this variety:

TRANSVAAL—2530 (Lydenburg): Kaapse Hoop (-DB), *Thorncroft* 2004 (PRE).

The collection of *Herbst s.n.* in NBG and STE, from Pietermaritzburg, is said to have had a red pattern in the throat. This was previously identified as var. *maculata*, but the red pattern does not correspond to the original description and figure of the variety. This collection is possibly *C. crocosmiflora* which often shows a red pattern in the throat of the perianth.

c. var. **pauciflora** (Milne-Redhead) De Vos, stat. nov.

Crocoshia pauciflora Milne-Redhead in Kew Bull. 1948: 469. Syntypes: Zambia, Mwinilunga distr. by R. Kaoomba, *Milne-Redhead* 3783 (K, lecto.; PRE); Angola, Moxico distr. by R. Kampashi, *Milne-Redhead* 4228 (K).

Plants up to 600 mm high, unbranched. *Inflorescence* a lax, 4–7-flowered spike with the axis in fruiting specimens often bent at the nodes. *Bracts* ca. 4 mm long. *Flowers* 20–25(–35) mm long. *Perianth tube* 10–15 mm long; *outer segments* recurved, 15–18 mm long. *Style* 22–27 mm. *Immature capsule* obscurely 3-lobed.

Flowering period: December to February.

Distribution: Zaire, Zambia and eastern Angola.

ZAIRE: Kabare, *Christiaensen* 1252 (MO); Bururi, *Lewalle* 3465 (MO).

ZAMBIA: NW Province, Mwinilunga distr.: Uapaca Woodland, *Hooper & Townsend* 279 (SRGH, C, K); R. Kaoomba, *Milne-Redhead* 3783 (PRE, K); West Lunga River, *Brummit e.a.* 14013 (SRGH, K).

ANGOLA: Moxico distr. by R. Kampashi, *Milne-Redhead* 4228 (K); Amboim, Capir, *Gossweiler* 10053 (LISC); Parc nat. de la Garamba, *Troupin* 2015 (K); Haut Katanga near Elizabethville, *Quarré* 4571 (K).

This variety, found only a few times, differs from the typical variety only in its spike with fewer, smaller flowers. Intermediates between this variety and var. *aurea* occur, such as *Robinson* 4373 in K, from the Chishimba Falls,

Kasama district in Zambia which has eight flowers up to 37 mm long; and Hall 424 in BOL, from the Chimanimani Mountains, Mocambique, has flowers as small as in this variety, but an inflorescence as in var. *aurea*. This is now placed with var. *aurea*.

C. cinnabarina may perhaps be identical with var. *pauciflora*. See under SPECIES INCOMPLETELY KNOWN.

2. *Crocoshia latifolia* N. E. Br. in Trans. Roy. Soc. S. Afr. **20**: 264 (1932). Type: Brown noted: "Described from cultivated specimens. Collector and locality unknown". Two specimens in K are designated as type specimens in Brown's hand. Both are from Comm. Van Tubergen Jnr, dated 18-8-04 and 27-8-04 respectively. The latter is chosen here as lectotype.

Plants probably 500-1 000 mm high. *Corms* not seen. *Scape* stout, apparently dull violaceous-green. *Basal leaves* several, lanceolate-ensiform, 300-450 × 20-40 mm, tapering from the middle to an acute or acuminate tip and a narrow base, with a strong middle vein and several more veins; *cauline leaves* few, smaller. *Inflorescence* a laxly branched panicle, each branch curved, with numerous fairly laxly and distichously arranged flowers. *Bracts* membranous, dark reddish-brown, 10-15 mm long; *outer* apiculate with a stronger median vein; *inner* bidentate with acuminate teeth, 2-veined. *Flowers* slightly zygomorphic, somewhat salver-shaped, 35-45 mm long, bright orange-red. *Perianth tube* narrowly funnel-shaped, slightly curved, 15-25 mm long, widened gradually from the base to 5 mm diam. at the throat; *segments* unequal, oblong, obtuse, spreading, 15-22 × 5-8 mm, the median posticous segment largest, the outer segments slightly eared at the bases. *Stamens* well exerted, about as long as the perianth segments; *filaments* ca. 17-20 mm; *anthers* 7-8 mm, yellow, pollen pale. *Style* 25-40 mm, exerted, branches 4-5 mm; *stigmas* widened, minutely fimbriate.

Flowering period in England: August.

This species was grown in the Van Tubergen nurseries in England and may perhaps be of hybrid origin. Plants sent to Kew were described by Brown. These are clearly related to *C. aurea* and *C. masonorum*, resembling the former in its flowers with narrow, slightly curved perianth tube, spreading segments and exerted stamens and style, differing in its slightly zygomorphic flowers and wider leaves with coarser veins. The leaves are apparently flat but have primary veins typical of plicate leaves; that is, the two veins of each pair of veins are unequal in size, the larger and smaller veins alternating towards the two leaf surfaces.

The species also resembles *C. masonorum* from the Engcobo district in

Transkei, in its wide leaves and slightly zygomorphic flowers, but differs in its lax panicle with ascending branches and distichous flowers.

C. latifolia is not known in the wild and may perhaps in future be treated as a dubious species.

3. *Crocoshia masonorum* (L.Bol.) N. E. Br. in Trans. Roy. Soc. S. Afr. **20**: 264 (1932).

Tritonia masonorum L.Bol. in Ann. Bol. Herb. **4**: 43 (1926). Syntypes: Tembuland, Engcobo Mt., 4500 ft, *H. Bolus 10303* (BOL, lecto.-); Near Satana Nek, mts between Engcobo & Zidungeni, *Mason & Mason* (K, icon).

Icons: Elovson, S. Afr. Wild Fls. Gard. **98** (1973); an unpublished water colour drawing by Miss M. H. Mason in K; this work Fig. 4.

Plants 500–750 mm or higher. *Corms* several, subglobose, superposed one upon another, 20–25 mm in diam.; tunics soon disintegrating. *Scape* 500–750 mm long, robust, cylindrical, polished. *Basal leaves* several, plicate, elongated-elliptical, up to 600 mm \times 20–50 mm, tapering gradually to an acuminate tip and a narrow stalk-like base ca. 5 mm wide, with a strong middle vein only in the lower part of the blade, and 6–12 more veins; cauline leaves up to 5, the lower imbricate, the upper distant and smaller. *Inflorescence* a simple or sometimes 1–2-branched spike with ascending branches, the main axis curved, with numerous flowers secund on the upper side of the curve, sometimes in approximating pairs. *Bracts* membranous, oblong to ovate, 4–10 mm long; *outer* shortly apiculate or acute; *inner* minutely bidentate, 2-veined in the upper part. *Flowers* slightly zygomorphic, funnel-shaped, later somewhat salver-shaped, 40–60 mm long, scarlet-orange to orange-yellow, drying to a brownish-yellow. *Perianth tube* funnel-shaped, slightly curved, 18–25 mm long, narrow in the lower half, widening gradually to 5–10 mm diam. at the throat; *segments* slightly unequal, elliptic, obtuse, spreading, at length somewhat recurved, 20–30 mm long, about as long as the tube or slightly longer, the three outer 5–7 mm wide, inner larger and 7–12 mm wide, with the posticous segment largest. *Stamens* well exerted, somewhat unilateral or spreading randomly; *filaments* 30–35 mm; *anthers* 7–9 mm, usually overtopping the perianth segments. *Style* well exerted, 42–45 mm; branches 2–4 mm, often overtopping the anthers; *stigmas* slightly widened or shortly bifid, fimbriate. *Capsules* depressed globose-3-lobed, 7 \times 9 mm; *seeds* wrinkled, 4 mm in diam. *Chromosome number* $2n = 22$ (Goldblatt, 1971).

Flowering period: December to January.

Distribution: on mountains in the Engcobo district of Transkei, probably rare. Fig. 2.



FIG. 4

Crocoscopia masonorum. a, spike, diagrammatic; b, flower; c, style branches, stigmas and anther; d, outer (left) and inner (right) bract; e, capsules; f, corms with tunics removed. (de Vos 2580)

TRANSKEI—3127 (Lady Frere): Engcobo Mt. (-DB), *Flanagan* 2731 (PRE), *H. Bolus* 10303 (BOL); Near Satana Nek, *Mason & Mason s.n.* (K, drawing).

Without locality, flowered in Kirstenbosch, *Milton* NBG 62866. STE 31365. Ex hort. Milton, Cala, *Milton s.n.* (MO); Ex hort. Transvaal, *de Vos* 2580 (STE).

This rare species probably has a very limited distribution and has thus far been found only a few times, perhaps owing to the inaccessibility of the terrain, on the southern extremities of the Drakensberg range in Transkei. It is, however, grown in some gardens in the Transvaal where it is known as Golden Swan *Crocoscopia* (Eliovson, 1973).

It is distinguished by its large pleated leaves and horizontally curved peduncle with all the flowers arranged on the upper side. The flowers are only slightly zygomorphic and open widely exposing the long stamens and style. The inner perianth segments are larger than the outer and the posticous segment largest. It stand nearest *C. mathewsiana* and differs from this in its inflorescence and flowers. In its vegetative stage it cannot be distinguished from either *C. mathewsiana* or *C. paniculata*.

4. *Crocosmia pottsii* (M'Nab ex Bak). N.E. Br. in Trans. Roy. Soc. S. Afr. **20**: 264 (1932).

Gladiolus pottsii M'Nab in Hort. Edinb., nom. nud.

Montbretia pottsii M'Nab ex Bak, in Gard. Chron. **8**: 424 (1877) & **11**: 525 (1880); Morren in Belg. Hort. **31**: 300 (1881). Type: Ex C.B.S., Hort. M. Leichtlin, Baden-Baden (K, holo.-).

Tritonia pottsii (M'Nab ex Bak.) Bak. in Curtis's Bot. Mag. **109** sub t. 6722 (1883) & Handb. Irid. 195 (1892) & in Fl. Cap. **6**: 127 (1896) excl. cit. Herb. Bolus 2652.

Icones: The Garden **84** (1880); Curtis's bot. Mag. t. 6722 (1883); Batten & Bokelmann, Wild Fls. E Cape Prov. Pl. 33 fig. 2a; this work Fig. 5.

Plants 700–1 000(–1 200) mm or higher. *Corms* depressed globose, 20–25 mm in diam., often two or more in a vertical row or connected by long slender stolons; tunics brown, papery or sometimes somewhat fibrous. *Scape* 700–1 000 mm or longer, erect, strong, cylindrical. *Basal leaves* several, plane linear-lanceolate, (100–)500–800 mm or longer \times (5–)8–15(–18) mm, acuminate, with a prominent middle vein and several



FIG. 5

Crococsmia pottsii. a, panicle, diagrammatic; b, flower; c, flower, split open; d, style branches and stigmas; e, outer (left) and inner (right) bract. (NBG 382/32)

more closely spaced veins, firm in texture; cauline leaves 2–3, up to 200 mm long. *Inflorescence* a lax panicle 150–350 mm long, with 1–3(–5) ascending, more or less straight or later faintly zigzag branches 150–200 mm long, each with numerous fairly laxly arranged, distichous flowers; or sometimes a simple spike up to 320 mm long. *Bracts* membranous, reddish-brown, ovate, 4–8 mm long; *outer* obtuse or acute or bluntly toothed; *inner* bidentate with short acuminate teeth, 2-veined, with papery margins. *Flowers* zygomorphic, funnel-shaped, 28–35(–40) mm long, bright deep-orange or orange-yellow, more or less flushed with brick-red on the outside. *Perianth tube* funnel-shaped, slightly curved, 14–20 mm long, slightly less than twice the length of the segments, narrow in the lower third, widening to 7–10 mm diam. at the mouth; *segments* unequal, obtuse, 8–15 × 5–7 mm, outer lanceolate, inner oblanceolate or elliptical, the posticous segment erect, slightly longer than the other five which spread slightly. *Filaments* 8–12 mm, slightly curved to the posticous side; *anthers* contiguous, 6–7 mm long, scarcely exerted from the perianth tube, pale. *Style* 20–30 mm, orange; branches 2–3 mm long; *stigmas* slightly widened or shortly bifid, minutely fimbriate, overtopping the anthers. *Capsules* shortly obovoid to subglobose-deeply 3-lobed, up to 8 mm in diam. (immature). *Chromosome number* $2n = 22$ (Goldblatt, 1971).

Flowering period: (November to) December to February.

Distribution: widely distributed in inland Natal to the Drakensberg, including Griqualand East, and also in Transkei; often on stream banks. Fig. 2.

NATAL—2830 (Dundee): Weenen County (-CC), *Acocks 13980* (PRE).

—2831 (Nkandla): Nkandla (-CA), *Gerstner 619* (PRE); Melmoth (-CB), *Mogg 6234* (PRE).

—2929 (Underberg): South Downs (-BB), *Evans 491* (NH); Prope Mooi River, M.-Wood 5222 (PRE, Z); Rosetta (-BD), *Young NH 20999* (NH); Boston, Impendhle (-DB), *Beattie 29* (NU); Mawahgwa Mt. (-DD), *Rennie 532* (NU); Bulwer-Impendhle rd, *Hilliard & Burt 7605* (NU); Everton, banks of Molweni Riv., *Hilliard & Burt 5624* (NU).

—2930 (Pietermaritzburg): Shafton, Howick (-AC), *Hutton 219* (GRA, PRE); Nottingham rd, distr. Drayton, *Smith 215* (NU); Lidgetton, M.-Wood 8337 (NH); Tweedie, *Tyson 2109* (BOL), M.-Wood 11053 (SAM); Greytown distr. (-BA), *Wylie NH 22419* (NH, PRE, K); Hilton rd (-CB), *Sidey 2059* (MO, S); Arnolds Hill, Richmond (-CD), *Wylie NH 23336* (NH).

—3029 (Kokstad): In rip. fl. Umzimhlava (-AD/-CB), *Schlechter 6547* (PRE, B, Z); Hela-Hela rd from Lufafa rd (-BA), *Shirley, 21/1/1978* (NU); Malowe Mts (-BD), *Tyson 2109* (SAM); Ad ripas fl. Umzimkulu pr. Clydesdale (-BD), *Tyson 2109* (BOL, GRA, K); Ca Kokstad (-CB), *Tyson 1372* (GRA, PRE, SAM, K). *Taylor 5572* (NBG); *Harding (-DB), Oliver NH 19132* (NH).

—3030 (Port Shepstone): Friedenau, Dumisa (-AD), *Rudatis 270* (S); Fairfield, Dumisa, *Rudatis 564* (STE, K); Rd to Umzinto (-BC), *Germish 1824* (PRE).

TRANSKEI—3128 (Umtata): Umtata (-DB), fld at Kirstenbosch, *Abernethy NBG 382/32* (BOL); Umtata Riv. (-BC/-DD), *Abernethy NBG 1035/36* (NBG).

Without precise locality: ex hort. *Leichtlin* (K).

According to Baker (1877) who described the species, it was introduced into Scotland by Mr G. H. Potts of Lasswade near Edinburgh who got it from the Cape, the precise locality not known. As it flowered there in August, it probably was grown from seeds—seedlings are able to adapt more readily to the seasons of the northern hemisphere. Mr McNabb of the Edinburgh Botanical Garden distributed it freely under the name *Gladiolus pottsii*. Baker's description was, however, not made from the Edinburgh plants, but from a specimen sent to Kew by Max Leichtlin who grew it in his garden at Baden-Baden. The source of these plants is also not known. The Leichtlin specimen preserved in the Kew herbarium constitutes the holotype. This has leaves 12–18 mm wide and not plicate. The plant illustrated as *Montbretia pottsii* in *The Garden* p. 84 (1880) and that in *Curtis's bot. Mag.* t. 6722 (1883) have apparently wider, plicate leaves, more like that of *C. mathewsiana*. The inflorescence, however, is that of *C. pottsii*.

C. pottsii is distinguished by its firm erect, plane, linear-lanceolate leaves with a prominent middle vein and several lateral veins, a panicle with ascending branches, a slightly curved perianth tube which is narrow near the base, then dilating fairly suddenly at or below its middle, and is about twice the length of the perianth segments; these are slightly spreading, except for the posticous one that is somewhat larger and porrect, thus protecting the stigmas.

5. *Crocasmia mathewsiana* (L.Bol.) Goldbl. ex De Vos, comb. nov.

Tritonia mathewsiana L.Bol. in *Ann. Bol. Herb.* 3: 76 (1923); *Flow. Pl. S. Afr.* 3: 94 (1923). Type: Transvaal, Graskop, Pilgrim's Rest, *Wood s.n.* NBG 542/16, filed at Kirstenbosch (BOL, holo.-).

Icones: *Flow. Pl. S. Afr.* 3 t. 94; this work Fig. 6.

Plants 1 000–1 500 mm or sometimes higher. *Corms* single or in superposed groups of 2–3, or connected by long slender stolons, depressed globose, 20–30 mm in diam., tunics brown, membranous, later fibrous. *Scape* 1 000–1 500 mm, largely covered with long leaf sheaths, cylindrical. *Basal leaves* 4–5, plicate, elliptic-ensiform, 750–900 × (20–)25–35 mm, tapering to an acute or acuminate tip and an almost stalk-like base, with numerous prominent veins; cauline leaves smaller, the uppermost reduced to ca. 60 mm in length. *Inflorescence* a large, lax panicle 200–300(–600) mm long, with 4–6 slender distichous, ascending and at length, spreading, curved or flexuose, primary and often also secondary branches (50–)100–150(–250) mm long, each with numerous flowers that are fairly densely arranged and usually almost secund on the upper side of the branches. *Bracts* largely membranous, the younger subherbaceous, reddish- or orange-brown, oblong, 3–6 mm long, shorter than the internodes; outer acute or apiculate,

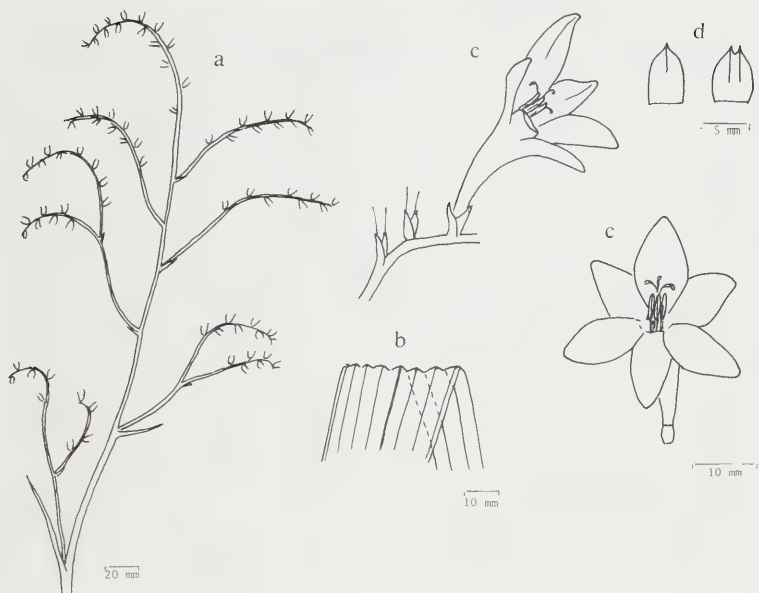


FIG. 6

Crocoscopia mathewsiana. a, panicle, diagrammatic; b, part of foliage leaf bent over, showing primary veins; c, flower; d, outer (left) and inner (right) bract. (from a drawing by M. M. Page in BOL)

keeled in the upper half; inner minutely bidentate, 2-veined. *Flowers* slightly zygomorphic, funnel-shaped, 28–38 mm long, reddish-orange, sometimes pinkish. *Perianth tube* funnel-shaped, slightly curved, 18–22 mm long, tubular in the lower quarter, widening gradually to ca. 7 mm diam. at the mouth; *segments* slightly unequal, ovate-elliptic, obtuse, at length spreading, 12–17 × 5–7 mm, the median posticous segment largest, 15–17 mm long. *Filaments* 13–15 mm; *anthers* contiguous, 5–7 mm, somewhat exserted, orange, reaching about halfway up the segments. *Style* 20–23 mm; branches 5 mm; *stigmas* slightly widened, minutely fimbriate, reaching the anther tips. *Cap-sules* subglobose-obscurely 3-angled, 8 mm long; *seeds* few, angled, 4 mm diam.

Flowering period: January to February.

Distribution: E Transvaal, in a small area on the Drakensberg escarpment, in damp shady places and on the margins of plantations. Fig. 2.

TRANSVAAL—2430 (Pilgrim's Rest): Mariepskop, Klaserie Riv. nr Waterfall (-DB), *Van der Schyff* 5973 (PRE); Graskop, fired at Kirstenbosch (-DD), *Wood* NBG 542/6 (BOL); Edge of the Berg, Graskop, *Galpin* 14383 (PRE), *Galpin s.n.* (BOL); Top of Kowyns Pass, *Leighton* 3257 (BOL, PRE); 5 mls from MacMac Falls towards Graskop, *Nel* 293 (NBG, PRE).

—2530 (Lydenburg): Lydenburg distr., *Burt Davy* 1477 (PRE); Betw. Sabie & Graskop (-BB), *Cassidy* PRE 36645 (PRE).

Without precise locality: Natal, *De Mole & Kirch* BOL 32340 (BOL).

This species is closely related to *C. paniculata* and can hardly be distinguished from the latter in the vegetative stage. It differs in its panicle which has slender, ascending, then curved or flexuose, not or only faintly zigzag branches with internodes longer than the bracts; and in its usually almost secund flowers with the perianth tube slightly longer than the segments and the posticous segment slightly larger than the other five almost equal segments.

Two collections in PRE, namely *Nel* 293 and *Cassidy s.n.*, vary in their pinkish flowers which are more slender than usual.

Goldblatt (1971: p. 422) used the name *C. mathewsiana* without officially transferring the species to *Crocasmia*.

6. ***Crocasmia paniculata*** (Klatt) Goldbl. in JI S. Afr. Bot. **37**: 444 (1971); Compton, JI S. Afr. Bot. Suppl. Vol. **11**: 140 (1976).

Antholyza paniculata Klatt in Linnaea **35**: 379 (1865) & in Abh. Naturf. Ges. Halle **15**: 345 (1882); Bak. in J. Linn. Soc. **16**: 180 (1877) & Handb. Irid. 229 (1892) & in Fl. Cap. **6**: 168 (1896). Type: Natal, without precise locality, *Gerrard* 1530 (K, holo.-; BOL).

Curtonus paniculatus (Klatt) N. E. Br. in Trans. Roy. Soc. S. Afr. **20**: 270 (1932); L. Bol. in S. Afr. Gard. **23**: 46 (1933); G. J. Lewis in Ann. S. Afr. Mus. **40**: 98, 102 (1954).

Icones: Pearse, Mountain Splendour p. 89 figs 2–5; this work Fig. 7.

Plants 1 000–1 300(–1 800) mm high. *Corms* single or in superposed groups of 2–3, depressed globose, 25–40(–50) mm diam.; tunics brown, membranous, later fibrous towards the top. *Scape* 1 000–1 500(–1 800) mm, strong, cylindrical, often reddish-brown. *Basal leaves* several, plicate, elliptic-ensiform, 400–600(–900) × (15–)25–50(–80) mm, oblique towards the base, tapering to an acute or acuminate tip and an almost stalk-like base, with numerous prominent veins, often with minute hair stumps on the veins; *cauline leaves* 150–200 mm, the lower ones sometimes plicate. *Inflorescence* a large panicle 100–200(–350) mm long, on a rigid scape up to 9 mm in diam., with 2–5 distichous, almost horizontal primary and sometimes secondary branches, each with a straight and then zigzag axis up to 150 mm

long and numerous densely arranged flowers which are at first distichous and later become somewhat secund on the upper side of the branches. *Bracts* submembranous, reddish-brown, obovate, 7–10 mm long, exceeding the internodes in length; *outer* obtuse or apiculate, slightly crisped at the top; *inner* shortly bidentate with acute teeth, 2-veined. *Flowers* strongly zygomorphic, narrowly funnel-shaped, (40–)50–75 mm long, orange-red, rusty red or brownish-orange, “*intus rubro-punctata*”? (cf. Klatt). *Perianth tube* curved,

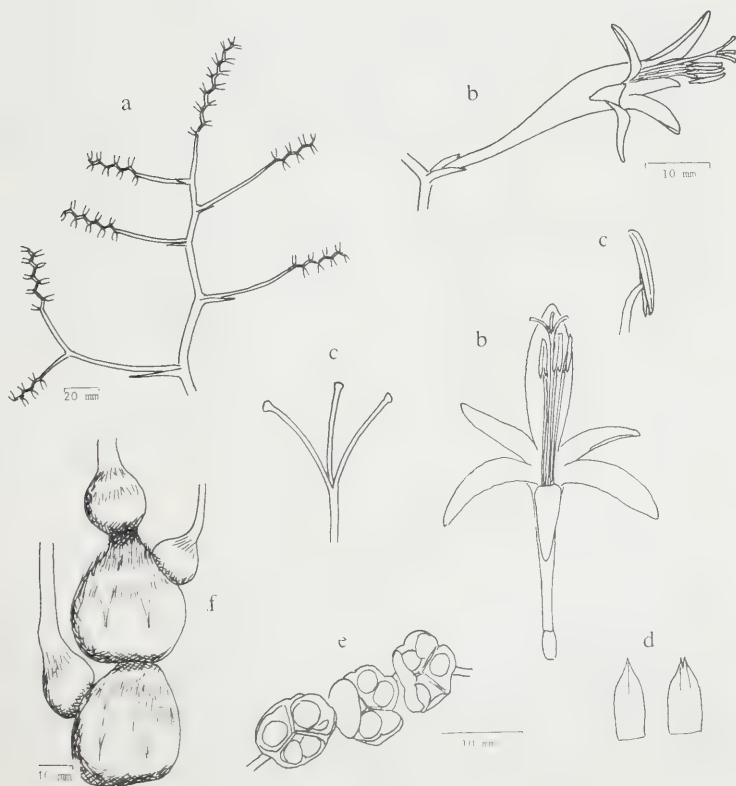


FIG. 7

Crocoscemia paniculata. a, panicle, diagrammatic; b, flower; c, anther, style branches and stigmas; d, outer (left) and inner (right) bract; e, capsules; f, corms, with tunics. (de Vos 2581)

tubular in the lower half, gradually widening to funnel-shaped, (25–)30–40(–45) mm long, more than twice the length of the segments, 5–7 mm in diam. at the oblique mouth; *segments* very unequal, obtuse; posticous segment erect, elliptic to lanceolate, (10–)15–18 × 6–9 mm, exceeding the other segments by 5–10 mm; upper laterals 7–10 × 5 mm, elongated-triangular, spreading, the three anticus segments elliptic, 6–12 × 3–5 mm, the median one smallest. *Filaments* 25–40 mm, curved towards the upper segment; *anthers* 6–8 mm, contiguous, placed towards the upper segment, reaching its tip; pollen pale. *Style* (35–)50–65 mm, branches 4–6 mm long; *stigmas* slightly widened or sometimes shortly bifid, reaching or overtopping the anthers. *Capsules* globose-3-lobed; *seeds* globose or angled, 4 mm diam. *Chromosome number* $2n = 22$ (Goldblatt, 1971).

Flowering period: December to February.

Distribution: Drakensberg of E Transvaal, NE Orange Free State, Natal, Lesotho, Swaziland and E Zimbabwe, in moist places and forest margins. Fig. 2.

TRANSVAAL—2430 (Pilgrim's Rest): Ohrigstad (-DC), *Jacobsen* 2250 (PRE); MacMac Forest Plantation (-DD), *Kopp* 1119 (PRE), *Mudd* BOL 32336 (BOL); Lisbon Waterfall, *Van Wyk* 816 (PRE); Graskop nr The Pinnacle, *Louw* 3207 (STE); Above MacMac Falls, *Goldblatt* 417 (BOL); Near MacMac picnic area, *De Vos* 2581 (STE).

—2529 (Witbank): Ca. 2 km E of Middelburg (-CD), *Onderstall* 208 (PRE); Wilgeboom Forest Sta. (-DD), *Leighton* 3251 (BOL).

—2530 (Lydenburg): Paardeplaats, Lydenburg, *Wilms* 1448 (S); Zwagershoek nr Lydenburg (-AB), *Obermeyer* 364 (PRE); Dullstroom (-AC), *Werdermann & Oberdieck* 2031 (PRE, K); De Kuilen (-BA), *Anderson* A148 (PRE); Rosehaugh (-BD), *Sim* NBG 3963/14 (NBG); 5 mls S of Machadodorp (-CB), *Bruce* 470 (PRE); Kaapse Hoop (-DB), *Van Jaarsveld* 1072 (PRE); Moodies (-DD), *Thornicroft* s.n. (K, MO); Nelsberg, *Knox-Davies* s.n. BOL 32335 (BOL).

—2531 (Komatipoort): Umlomati Valley, Barberton (-CC), *Galpin* 1211 (BOL, GRA, PRE, SAM); Lomati (-CD), *Williamson* 265 (PRE).

—2630 (Carolina): 24 mls E of Ermelo (-AD), *Codd* 6380 (PRE); Nr Athole Pasture Stn (-CB), *Codd* 384 (PRE).

—2730 (Vryheid): Oshoek (-AD), *Devenish* 563 (PRE, RSGH).

SWAZILAND—2631 (Mbabane): Hawane Falls (-AA), *Compton* 27402 (NBG); Mbabane (-AC), *Rogers* 11850 (K); Dralriach, *Bolus* 12357 (BOL); Nr Forbe's Reef (-BD), *Compton* 26519 (NBG); Usutu Forest (-CA), *Keet* NBG 64782 (NBG).

ORANGE FREE STATE—2828 (Bethlehem): Bestersvlei nr Witzieshoek (-DB), *Flanagan* 6500 (PRE), *Jacobsz*, *Bolus* 8301 (BOL, GRA).

—2829 (Harrismith): Zaaiohoek, distr. Harrismith, *Thode* 8522 (STE); 8 mls SSW of Harrismith (-AC), *Acocks* 23829 (PRE); Foothills of Platberg, *Van der Zeyde* NBG 95739 (NBG).

LESOTHO—2828 (Bethlehem): Leribe (-CC), *Dieterlen* 458 (PRE, SAM, K).

ZIMBABWE—(Melsetter): Umtali, Cloudlands, Vumba, *Chase* 6315 (SRGH).

Without precise locality: *Mudd* s.n. (K); Natal, *Wood* 3499 (K); Natal & Zululand, *Gerrard* 1530 (BOL, K).

This high altitude species from the eastern parts of southern Africa is

known as Waaierlelie (Eliovson, 1973). The plants are large and have large pleated leaves and a strong scape terminating in a large panicle with distichous branches. Each branch diverges from the main branch at an almost right angle and consists of a straight, rigid, single-internoded lower part 40–100 mm long and a strongly zigzag upper part with numerous short internodes and numerous closely arrayed, long-tubed flowers. These somewhat resemble those of certain species of *Chasmanthe* and *Anapalina*. In the Transvaal the shoot dies down in winter.

C. paniculata is closely related to *C. mathewsiana* and *C. pearsei*, and in the vegetative stage these species can hardly be distinguished. It differs from the former in its more strongly zygomorphic, longer-tubed flowers with more unequal perianth segments which arise obliquely from the tube; the posticous segment is largest and arises three to five millimetres beyond the anticus lobe. The inflorescence differs in its widely spreading, strongly zigzag branches, with internodes shorter than the bracts. See further under *C. pearsei* and *C. fucata*.

The monotypic genus *Curtonus* is one of the eight genera established by N. E. Brown (1932) for the heterogeneous collection of species that were placed in *Antholyza*. *Curtonus* was upheld by Phillips (1941, 1951), but L. Bolus (1933) thought that "the genus rests on too weak a basis to be stable" and that it should be combined with *Chasmanthe*. Lewis (1954) on the other hand, suggested that *Curtonus*, although closely related to *Chasmanthe* and *Crocoshmia*, should be kept separate. As a result of his chromosome studies of South African Iridaceae, Goldblatt (1971) came to the conclusion that *Curtonus paniculatus* must be included in the genus *Crocoshmia*, on grounds of similarities in their karyotypes as well as their morphology. This view is upheld here.

7. ***Crocoshmia pearsei*** Oberm. in *Bothalia* 13: 450 (1981). Type: Natal, summit of Mnweni Pass in Drakensberg, *Pearse* 34 (PRE, holo.-).

Icones: *Bothalia* ibid. Fig. 21, 22; *Pearse*, Mountain Splendour p. 87, fig. 3.

Plants 800–1 000 mm high. *Corm* tunicated, with fibrous tunics. *Shoots* deciduous. *Scape* up to 1 000 mm long, erect, green, covered with leaf bases for most of its length. *Basal leaves* several, plicate, narrowly elliptical, tapering to an acute tip and an almost stalk-like base, ca. 500 × 35–70 mm; cauline leaves smaller. *Inflorescence* a simple erect spike, sometimes with a short basal side branch, with numerous densely arrayed distichous, or sometimes secund, ascending-spreading flowers on a straight or faintly zigzag axis. *Bracts* membranous, reddish-brown, ovate, erect, 8–10 mm long; *outer* apiculate; *inner* minutely bidentate. *Flowers* strongly zygomorphic, largely

tubular or narrowly funnel-shaped, 70–90 mm long, orange. *Perianth tube* curved, tubular in the lower third, gradually widening to ca. 10 mm at the oblique mouth, 40–55 mm long, about twice the length of the segments; *segments* very unequal, elliptic, obtuse, somewhat obliquely attached, with the posticous segment longest, erect $20-30 \times 10-12$ mm, other segments $14-16(-20) \times 7-8$ mm, slightly spreading. *Filaments* ca. 45–50 mm; *anthers* slightly exserted, 6–7 mm long. *Ovary* 7–9 mm long; *style* 50–60 mm, branches exserted, orange; *stigmas* slightly widened or shortly bifid. *Cap-sules* (immature) 8×6 mm.

Flowering period: January.

Distribution: on summits of two Drakensberg passes, near Cathedral Peak and Mont-aux-Sources (2 200–3 000 m). Fig. 2.

NATAL—2828 (Bethlehem): Icidi Pass, Drakensberg (-DD), *Gray s.n.* PRE 58368 (PRE).

—2829 (Harrismith): Summit of Mnweni Pass, Drakensberg (-CC), *Pearse 34* (PRE).

This high altitude species has been collected only three times, at altitudes of 2 200–3 000 m. It is very closely related to *C. paniculata* which usually also occurs at high altitudes. It might perhaps be regarded as a variety of the latter species. It differs from the latter in its somewhat larger flowers with larger ovary and wider perianth segments, and in its green scape terminating in a simple or one-branched spike with a more or less straight or only faintly zigzag axis. It also differs in habit: the plants are solitary and the leaves deciduous, whereas *C. paniculata* forms large clumps and has evergreen leaves, according to Obermeyer. (S. Eliovson, however, mentions (1973) that these plants die down in April, and I also found only withered specimens of this species in July 1982 in the eastern Transvaal.)

8. *Crocoshmia fucata* (Herb.) De Vos, comb. nov.

Tritonia fucata Herb. Bot. Reg. **24** t. 35 (1838): Loudon, Ladies Fl. Gard. Ornam. Bulb. Pl. 75 & Pl. 16/1 (1841); Klatt in Linnaea **32**: 758 (1863), pro parte, excl. cit. Iconotype: Bot. Reg. **24** t. 35 (lectotype here designated).

Antholyza fucata (Herb.) Bak. in J. Linn. Soc. **16**: 180 (1877) & Handb. Irid. 229 (1892) & in Fl. Cap. **6**: 167 (1896); Klatt in Ber. Naturf. Ges. Halle **15**: 345 (1882).

Chasmanthe fucata (Herb.) N. E. Br. in Trans. Roy. Soc. S. Afr. **20**: 274 (1932); L. Bol. in S. Afr. Gard. **23**: 46 (1933); G. J. Lewis in Ann. S. Afr. Mus. **40**: 98 (1954).

Petamenes fucata (Herb.) Phill. in Bothalia **4**: 44 (1941).

Icones: Bot. Reg. **24** t. 35; Loudon, Ladies Fl. Gard. Ornam. Bulb. Pl. pl 16/1; this work Fig. 8.

Plants 1 300–1 700 mm high. *Corms* depressed globose, 30–50 mm diam., often superposed in vertical or horizontal rows of 2 or more; tunics thin, papery, soon disintegrating. *Scape* 1 300–1 700 mm, erect rigid, cylindrical, reddish-brown on the side facing the sun. *Basal leaves* several, plane, linear-ensiform, acuminate, (700–)1 000–1 200 × 15–30 mm, with a prominent middle vein and several primary veins; *cauline leaves* few, to 200 mm long. *Inflorescence* a long, erect or curved spike up to 220 mm long, often with 1–2 ascending branches which have a 70–120 mm long straight lower part and a slightly zigzag upper part with numerous densely arranged flowers

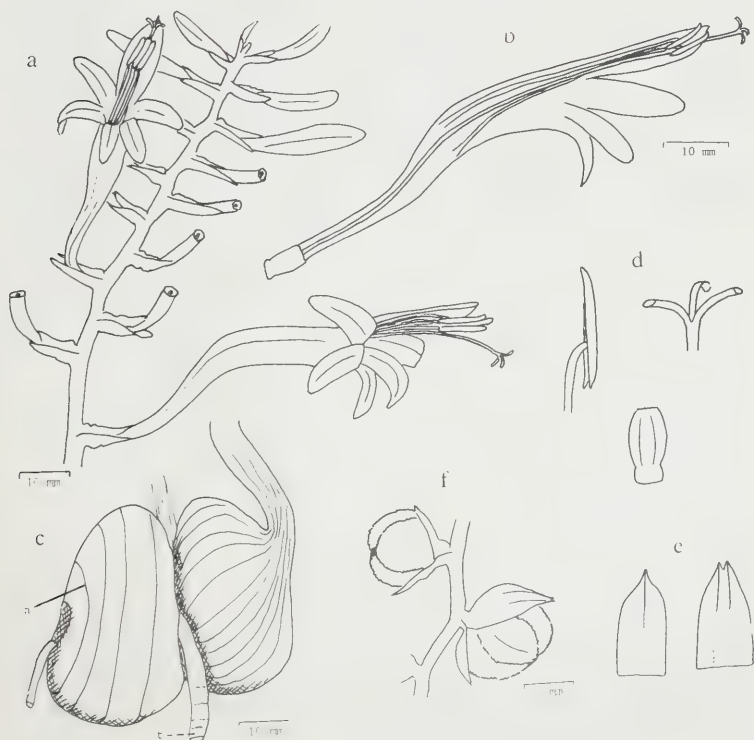


FIG. 8

Crocoscopia fucata. a, spike; b, flower, median section; c, corms, old without tunics (left) and new corm (right) with tunics; d, anther, style branches, and stigmas and ovary; e, outer (left) and inner (right) bract; f, capsules. (*de Vos* 2579)

which are distichous in bud and in fruiting stage and sometimes secund in flowering stage. *Bracts* subherbaceous, dark red on side facing the sun and green on opposite side, 8–12 mm long; *outer* elliptic, subobtusely or irregularly lacerated, with obscure veining; *inner* elliptic-triangular, minutely bidentate, obscurely 2-veined, slightly longer than the outer, with a lateral bulge near the base. *Flowers* strongly zygomorphic, curved, narrowly funnel-shaped, 65–80 mm long, cherry-red on posticous side (RHS 45A-C, 46B), saffron-yellow or greenish-yellow on anticous side (RHS 21C or 4A). *Perianth tube* curved, tubular in the lower third, gradually widening to cylindrical (ca. 7 mm diam.) in the upper half, with a slight posterior bulge where it widens and an oblique mouth; segments unequal, elliptic to elliptic-triangular, subobtusely, the posticous segment largest, arising ca. 4 mm beyond the anticous, porrect, (12–)15–18 × 6–8 mm; other segments spreading or slightly recurved, the three anticous segments smallest, 10–12 × 4–5 mm, yellow with median stripes. *Filaments* ca. 35 mm; *anthers* 7–8 mm long, contiguous, purplish-red, placed against the posticous segment and reaching its tip or higher; pollen pale yellow. *Ovary* ellipsoid, 5–7 mm long, broad based; *style* 60–75 mm, red, branches 3–4 mm; *stigmas* slightly widened, overtopping the anthers and posticous segment. *Capsules* globose-trilobed, with a rough surface; *seeds* angled, wrinkled, 5 mm in diam. *Chromosome number* $2n = 22$ (see p. 469)

Flowering period: November to December.

Distribution: found only on a few farms on the Kamiesberg of Namaqualand, in wet kloofs. Fig. 1.

CAPE—3017 (Hondeklipbaai): “Nieuw Kerksfontyn” (=Niekersfontein? -BB), *Pappe s.n.* (SAM); Upper S W slopes of Sneeuokop (-AA), *Pearson 5760* (BOL). —3018 (Kamiesberg): Farm Modderfontein, Jongenskloof, *de Vos 2579* (STE).

This probably rare species has been collected a few times only on the Kamiesberg in wet kloofs. It is, however, well-known to those farmers on whose farms it occurs. The earliest collection was brought from an unknown locality in the Cape to William Herbert's garden in England where the corms grew and multiplied for about 25 years without flowering. After applying a dressing of manure in 1836, the plants flowered the following year, whereupon Herbert described and figured the species in 1838 as *Tritonia fucata*. The locality of the species remained unknown until the nineteenth century when specimens were gathered in the Kamiesberg, by either Pappe or Zeyher, and again in 1910 by Pearson. (Pappe, who had acquired Zeyher's herbarium, was in the habit of rewriting Zeyher's labels). The third collection of the species was made by the present author in 1983. On account of it

flowering from November to December, which for Namaqualand is a late flowering period and the fact that plants not in flower resemble *Watsonia*, it is probable that the species has been overlooked by most collectors.

Several investigators recognised the close relationship between this species and *C. paniculata*, notwithstanding the fact that the distance separating their distributions is about 1 000 km. Baker (1892, 1896) placed *C. fucata* next to *C. paniculata* (both as *Antholyza*) in his treatment of the Iridaceae. L. Bolus (1933) regarded both as species of *Chasmanthe*, but Lewis (1954) proposed that *C. fucata* should be transferred to *Curtonus*, a monotypic genus which was established by Brown (1932) to harbour *C. paniculata* and which, "although closely related to *Chasmanthe*, seems to be sufficiently distinct to merit generic status" (Lewis, 1954: p. 98). In 1971 Goldblatt, however, transferred *C. paniculata* to *Crocoshmia* where it undoubtedly belongs. As he had no fresh material of *C. fucata*, he did not examine its chromosomes. These could now be counted.

C. fucata is undoubtedly closely related to *C. paniculata*. They have similar persistent, many noded corms in superposed rows, strongly zygomorphic flowers with long, gradually widening perianth tube and porrect posticous perianth segment, anthers bifid from their bases for about one-third of their length, almost similar laxly branched inflorescences with long branches which are bare and straight in their lower half and which bear flowers only in their upper half, subglobose capsules with few seeds in which the outer layers of the testa are loose, and chromosome number of $2n = 22$. The only significant differences are the leaves which are plane in *C. fucata* and plicate in *C. paniculata*, and the capsules which have a rough surface in *C. fucata*.

Both these species differ from *Chasmanthe* in which *C. fucata* had been included, in their persistent corms, gradually widening perianth tubes, anthers that are equally high and bifid for only one-third of their length (in *Chasmanthe* the anthers are bifid for almost half their length and one anther stands higher than the other two), shorter capsules with seeds which have loose outer layers, and in their chromosome number of 22 instead of 20 in *Chasmanthe*.

A *CROCOSHMIA* HYBRID

9. *Crocoshmia* × *Crocoshmiiflora* (Lemoine ex Morren) N. E. Br. in Trans. Roy. Soc. S. Afr. **20**: 264 (1932), (*C. pottsii* × *aurea*).

Montbretia × *crocoshmaeflora* Lemoine ex Morren in Belg. Hort. **31**: 299 & t. 14 (1881); André in Rev. Hort. Paris 124 (1882); Fitch (del.) in Flor. Mag. n.s.pl. 472 (1881?) as *crocoshmaeflora*; Bak. in Fl. Cap. **6**: 129 (1896) as *crocoshmaeflora*. Iconotype: Belg. Hort. 31 t. 14 (lectotype here designated).

Tritonia \times *crocsmiflora* Nicholson, Dict. Gard. 4: 98 (1888). Type: Flor. Mag. t. 472 (lectotype here designated).

Icones: Belg. Hort. 31 t. 14; Flor. Mag. t. 472; Eliovson opp. p. 131 (1973); this work Fig. 9.

Plants 250–500(–1 000) mm high. *Corms* often in superposed groups of 2–3 or connected by long slender stolons, depressed globose to ovoid 15–25 mm in diam.; tunics membranous, brown. *Scape* 250–500(–1 000) mm, usually 2–3-ribbed, strong. *Basal leaves* several, plane, linear-lanceolate or ensiform, acute, 300–500 \times 8–15(–20) mm, with a prominent middle vein and several more veins; cauline leaves smaller than the basal. *Inflorescence* a lax panicle 200–450 mm long, with several ascending-spreading, later slightly zigzag branches, each with 4–8 or more distichous flowers. *Bracts* sub-membranous, reddish with brownish tips, 6–10 mm long; *outer* acute; *inner* bidentate, 2-veined, 2-keeled in the upper part. *Flowers* slightly zygomorphic, funnel-shaped, 30–40 mm long, orange or reddish-orange (RHS 28A–33A), slightly paler towards the throat, sometimes with a reddish mark on the anticus or on all perianth segments in the throat. *Perianth tube* fun-

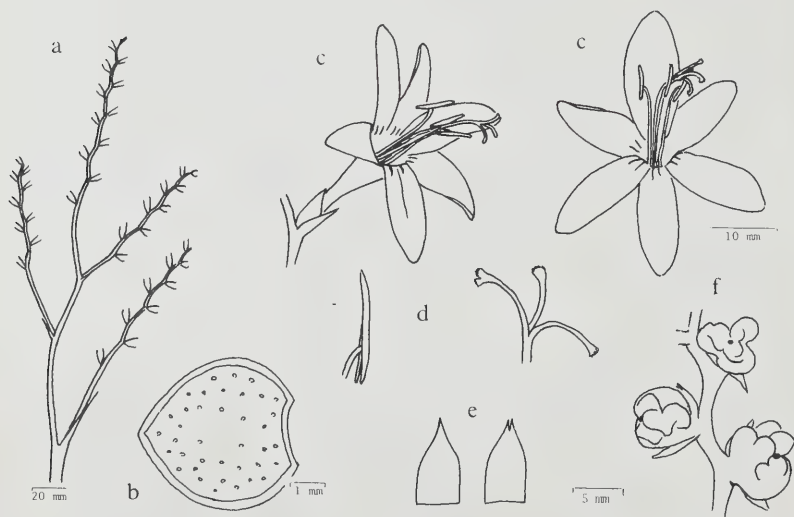


FIG. 9

Crocsmia \times *crocsmiflora*: a, panicle, diagrammatic; b, peduncle in transverse section; c, flower; d, anther, style branches and stigmas; e, outer (left) and inner (right) bract; f, capsules abortive. (de Vos 2574).

nel-shaped, slightly curved, 10–15 mm long, widened to 4–6 mm at the mouth, subequal to the segments; *segments* subequal, slightly spreading, lanceolate to oblong, obtuse, 15–20(–25) \times 6–9 mm, the outer often with recurved tips. *Filaments* 15–22 mm; *anthers* widely exserted, 6–8 mm long, orange-yellow, reaching the upper half of the perianth segments. *Style* 30–35 mm; branches ca. 4 mm long, widely exserted, overtopping the anthers and often also the perianth tips; *stigmas* slightly widened or shortly bifid at the tips, minutely fimbriate. *Capsules* few, nodose and deeply 3-lobed, up to 7 \times 9 mm, usually without viable seeds. *Chromosome number* $2n = 22$ (Goldblatt, 1971).

Flowering period: January (Cape) to April (Transvaal).

Distribution: a garden hybrid known as Garden Montbretia or Autumn Gold. Garden escapes occur world-wide.

This hybrid was developed by the French horticulturalist Victor Lemoine at Nancy in the nineteenth century, when he fertilised *C. pottsii* with pollen of *C. aurea*. His plants flowered for the first time in August 1880, after which he released them in the trade under the name *Montbretia crocosmiaeflora*.^{*} It has become a fairly popular garden plant and specimens are preserved in several herbaria. Garden escapes have been found in numerous countries. In South Africa it occurs for example near George (*Viviers 131* in STE), in the Tsitsikamma National Park (*Liebenberg 7957* in PRE), and at Port St. Johns (*Galpin* NBG 258/29 in BOL). It has also been found in Uganda (*Nothill 2742* in K, *Kaunda 1* in MO), Kenya (*Clarke e.a. 40J* in K), Mauritius (*Lorence 2278* in MO), Madagascar (*Croat 29890* in MO), New Guinea (*Millar 12151* in L), Bolivia (*Badcock 873* in B), as well as in Sumatra, Hawaii and Malaya.

C. crocosmiaeflora has characters intermediate between its two parent species. It is distinguished by slightly zygomorphic, funnel-shaped flowers with a perianth tube subequal to or slightly shorter than the segments and with exserted anthers and style branches. The flowers open wider than in *C. pottsii* but the perianth lobes are not widely reflexed as in *C. aurea*. The leaf texture is intermediate: not as soft textured and silky as in *C. aurea* and not as rigid as in *C. pottsii*; the prominence of the veins is also intermediate between the two parent species. There is a considerable range of colour within the limits of orange and yellow, and reddish marks sometimes occur in the throat of the perianth. The peduncle is usually two-edged—another character intermediate between the ribbed peduncle of *C. aurea* and the smooth one of *C. pottsii*.

^{*} Since then many seedling forms have been raised, especially in England (cf. *Dict. of Gardening*).

The figure in *Flowering Plants of S. Africa* 4 Pl. 152 (1924) sub *C. crocosmaeflora* is that of a plant from the botanical garden of the Division of Botany, Pretoria, which is preserved in that herbarium as PRE 2848. This figure, as well as the herbarium specimens, shows several features that stand closer to *C. aurea* than to the hybrid, such as a ribbed peduncle, widely spreading perianth segments and widely exerted stamens and style. The only typical hybrid character is the stronger textured leaves which are evident in the preserved specimens. Indeed, a note by R. A. Dyer on one of the two herbarium sheets states that the F.P.S.A. supposition has no proof, and that this plant may still be *C. aurea*. Perhaps these plants were a back cross between the hybrid *C. crocosmiiflora* and *C. aurea*. This can explain the predominance of *C. aurea* characters.

SPECIES INCOMPLETELY KNOWN

***Crocoshmia cinnabarina* (Pax) De Vos** in Jl S. Afr. Bot. **49**: 415 (1983).

Tritonia cinnabarina Pax in Bot. Jb. **15**: 152 (1893); Bak. in Fl. Trop. Afr. **7**: 357 (1898). Type: Angola, Catala Ganginga, Teusch, in Exped. A. von Mechow 573 (B, holo.-).

Plants up to a metre high. *Corms* globose, ca. 15–45 mm in diam.; tunics papery, brown. *Scape* up to a metre, slightly 2-edged. *Basal leaves* said to be absent; cauline several, plane, ensiform, somewhat sickle-shaped, overtopping the scape, 400–600 × up to 25 mm, with a prominent middle vein and several other smaller veins, thin-textured. *Inflorescence* a lax spike with two short ascending, 3–4-flowered, zigzag branches. *Bracts* hyaline-membranous or scarious, triangular, acute, 3–5 mm long. *Flower* in a not fully developed stage 15 mm long, funnel-shaped, vermilion. *Perianth tube* 5 mm long; *segments* in a young condition slightly unequal, oblong or lanceolate, twice the length of the tube. *Style* slender, equal to the stamens, with somewhat cuculate branches. *Capsule* obtusely angled-globose, ca. 10 mm in diam.; *seeds* angled, brown, 4 mm in diam.

Flowering period: January.

Distribution: Angola.

This species is known only from its type specimen brought back from Angola by the A. van Mechow expedition of 1881. Pax probably never saw an open flower and his description is that of a flower in a “nicht völlig entwickelten” stage, with included stamens and style, and acute perianth segments. The type specimen in the Berlin–Dahlem herbarium has indications of six flowers on the main axis and three to four on the branches of the inflorescence. Now only one flower bud and an immature capsule are preserved.

It is undoubtedly a *Crocasmia* related to (if not identical with) *C. aurea* var. *pauciflora* which also occurs in Angola. There is no knowing whether the stamens and style would not become exerted in fully open flowers. If this is the case, there is no reason why the species cannot be conspecific with *C. aurea* var. *pauciflora*.

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Thanks are due to the directors and curators of the herbaria mentioned in this study, from whom specimens of *Crocasmia*, including types, were obtained for examination; to several people who helped in collecting fresh material from their natural habitats; and to the Head of the Department of Botany of the University of Stellenbosch for facilities to work in the department after my retirement.

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TEN NEW SPECIES OF *ERIOSPERMUM* JACQUIN (LILIACEAE) FROM THE WESTERN CAPE

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ABSTRACT

Ten new species of *Eriospermum* from the western Cape are described. Of these 7 previously had manuscript names which are here validated. Discussion on the relationship of these to each other or previously described species, is included.

UITTREKSEL

TIEN NUWE *ERIOSPERMUM* JACQUIN (LILIACEAE) SPECIES VAN DIE WES-CAPE

Tien nuwe *Eriospermum*-species vanaf die Wes-Kaap word beskryf. Sewe van hulle het tevore manuskripname gehad wat hier gewettig word. 'n Bespreking van die verwantskap van hierdie species onderling en ander voorheen beskryfde species, word ook gedoen.

Key words: *Eriospermum*, sp. nov., Liliaceae, western Cape.

Eriospermum is a comparatively large genus distributed over most of sub-Saharan Africa, with a concentration of species in southern Africa, especially in the drier parts of the western Cape. Although usually placed in Liliaceae, it has some very distinctive features and in some classifications (Lotsy, 1911; Huber, 1977; and Dahlgren & Clifford, 1982) it has been placed in its own family Erioseptaceae.

Members of the genus are easily identifiable by the presence of an underground tuber and the seed which is covered by long hairs. The leaf, in most cases, is atypical of monocotyledons, having a petiole-like part, referred to as a leaf sheath, with frequently a broadly ovate or orbicular lamina. Usually only a single leaf is produced each year. Flowers tend to be small and of several different shapes, mostly quite distinctive, although in some cases they may be mistaken for other genera such as *Drimia* or *Ornithogalum*. If the complete plant is available, a number of characters make species identification comparatively easy. Unfortunately the majority of species, in

particular those from the winter rainfall region, are hysteranthous, resulting in a vast amount of herbarium material which is incomplete.

Since Baker's revision of the genus in 1896, a considerable number of new species have been described and several people have worked on the genus. Notable among these are Rudolf Marloth and A. V. Duthie, who advanced knowledge of the genus considerably by amassing large collections of living and pressed material, for which they made detailed notes and drawings. In addition to the seven new species described by Marloth and six by Duthie, some fifty manuscript names have been attached to their sheets. Having myself studied some 750 living collections from many parts of southern Africa, as well as herbarium material in the main herbaria in South Africa and in several European countries, I feel in a position to comment on and validate some of their manuscript names. In addition to the seven species bearing Marloth's manuscript names and which are described here for the first time, three species, based on my own collections, are also newly described. These are related to some of the Marloth species.

Eriospermum deserticolum Marloth ex P. L. Perry, sp. nov; differt a speciebus omnibus aliis gemma longa acutaeque, segmentis perianthii attenuatis, staminibus parvis. Ab *E. pusillum* et *E. exilis* tuberibus, rhizomis atque vagina folii pubescenti, distinguitur.

Plantae hysteranthae. *Tubera* irregulariter formata, 30 mm × 20 mm lata, rhizomatibus; caro alba; crescens acumen laterale. *Folium* erectum; vagina folii, quae eodem tempore est, usque ad 55 mm supraterranea, filo metallico similis, tecta pilis patentibus albisque; lamina variabilis magnitudine et forma, parva, ovata cordata vel anguste ovata usque ad lanceolatam, 125 mm longa, 27 mm lata; superficies ambae atrovirentes; apex acuminatus. *Scapus* usque ad 240 mm longus, filo metallico similis, ciliis minutis diaphanis ad basim; bractea pedunculata 2–4 mm supraterranea, attenuata, undulata. *Racemus* secundus, usque ad 200 mm longus, usque ad 20 floribus. *Bractee* 1,5 mm longae, albae, carina dilute brunnea, attenuatae. *Pedicelli* 3–4 mm longi. *Perianthium* urceolatum; segmenta dimorpha, alba, extus costa dilute viridi usque ad rubellam, intus lampro-aurea; segmenta exteriora 7 mm longa, 2 mm parte latissima, elliptica, apice angusto attenuato plus quam 3 mm longo atque marginibus intro plicatis; segmenta interiora 8 mm longa, 3 mm lata, spatulata, apice angusto plus quam 4 mm longo, intro plicato, projecturis ciliatis secus marginem. *Stamina* adnata ad segmenta secundum 1,5 mm; fila alba, parvissima; antherae atropurpureae. *Ovarium* ovoideum, 1,5 mm altum, 1 mm latum. *Stylus* 1,5 mm longus.

Type: South Africa, Cape Province, 58 km Springbok towards Komaggas, fl. ex hort Karoo Botanic Garden, 24/2/1980, Perry 1121 (NBG, holotype; K, PRE, isotypes). (Fig. 1).

Plants hysteroanthous. *Tubers* irregularly shaped, rhizomatous, up to 30 mm × 20 mm across; rhizomes up to 120 mm long and 4 mm diameter; skin light brown; flesh translucent-white; growing point lateral. *Leaf* solitary erect; old persistent sheaths up to 120 mm below ground, membranous, tan-brown; contemporary leaf sheath exerted by up to 55 mm, wiry, barely 1 mm diameter, dark red, covered with patent white hairs; lamina variable in size and shape, in younger plants ovate-cordate and approximately 13 mm long and 9 mm wide becoming narrowly ovate to lanceolate, up to 125 mm long and 27 mm wide; both surfaces darkish green, glabrous, occasionally with a few hairs towards the base on the lower side and margin; apex acuminate. *Scape* up to 240 mm long, 0.5 mm diameter, wiry, reddish at the base, green above with faint red streaking, bearing minute tooth-like transparent cilia basally; peduncular bract exerted by 2–4 mm, pinkish-red, attenuate, margin undulate. *Raceme* tends to be secund, up to 200 mm long with up to 20 flowers. *Bracts* 1.5 mm long, membranous, whitish with faint brown keel, attenuate. *Pedicels* 3–4 mm long, whitish to pale green. Buds pointed. *Perianth* urceolate; segments dimorphic, dull whitish on the outside with a faint green midrib and suffused red streaking, inside translucent, shiny golden appearance, joined for more than 1 mm at the base; outer segments 7 mm long, elliptic basally, with a narrow attenuate tip over 3 mm long and margins folded inwards; inner segments 8 mm long spatulate basally, tip more than 4 mm long and folded inwards, transparent cilia-like projections along the margins; apices spreading to reflexed resembling a 6-point star. *Stamens* adnate to segments by 1.5 mm; filaments white, very small; outer narrowly ovate, less than 1 mm × 1 mm, inner triangular, slightly longer than outer; anthers deep purple, copious nectar produced at the base of the filaments. *Ovary* ovoid, 1.5 mm high, pale green with faint red spotting. *Style* 1.5 mm long, white.

Flowering time: February to March. Leafing period: March to October.

Distribution: *E. deserticum* is found growing in clumps in the shade of rocks or shrubs on granite slopes or sandy gravel soils from the Richtersveld in the north through Namaqualand, to as far south as the Kamiesberg. (Fig. 3a).

The long pointed bud and flower with extra long perianth segments and small stamens, make this species quite distinct from all previously described species. In leaf it can usually be distinguished by the patent hairs along the leaf sheath.

Specimens incorporated into the National Herbarium at Pretoria and the herbarium at Stellenbosch, include several collections from Namaqualand with this very distinctive flower type. The manuscript names *E. meyeri*, *E. deserticum* and *E. gracile* have been appended, apparently by Marloth, to different sheets. Among the information attached to the sheets is a typed

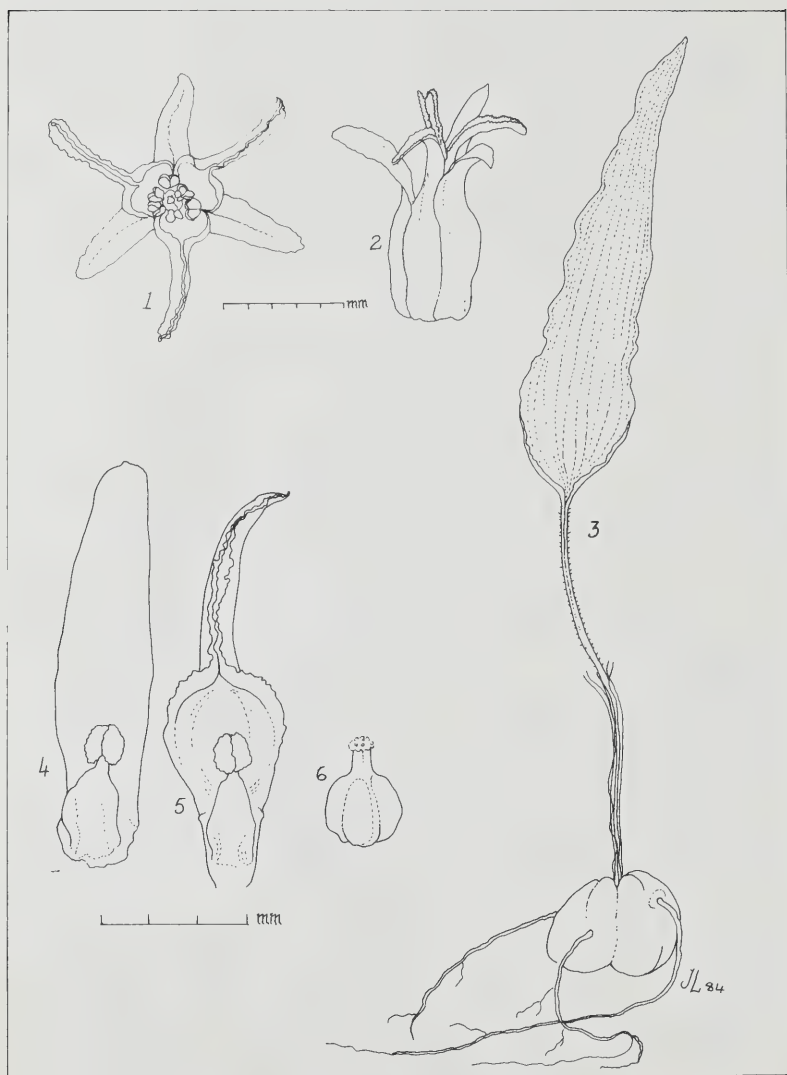


FIG. 1.

Eriospermum deserticum. 1. Flower, face view; 2. Flower, side view; 3. Tuber and leaf, natural size; 4. Outer perianth segment and stamen; 5. Inner perianth segment and stamen; 6. Gynoecium. (Perry 1051, NBG).

note by Duthie, pointing out the similarity and the distinctiveness of the flowers and that they are very closely allied and posing the question "How do they differ?". Careful examination of these specimens and several living collections from the original localities indicates that they all belong to the same species and the name *E. deserticolum* has been chosen for this taxon.

A possible reason for the confusion of names may be the variability of leaves in this species, especially those of different ages and the more numerous vegetatively produced leaves from the ends of rhizomes. Young leaves tend to be broadly ovate-cordate and horizontal, whereas the adult leaf is erect and narrowly lanceolate with a long wiry contemporary leaf sheath about equal in length to the lamina and frequently covered with longish white hairs.

SPECIMENS EXAMINED

CAPE PROVINCE—2817 (Vioolsdrif): 13 miles north of Anenous towards Eksteenfontein (-CD), *Bruyns* 1491 (NBG).

—2917 (Springbok): Steinkopf (-BC), *Duthie* 640 (STE); Steinkopf, *Marloth* 6979, coll. Rev. Meyer (PRE); Steinkopf, *Marloth* 6453 (STE); 1 km west of Steinkopf, *Perry* 1051 (NBG); 20 km west of Springbok towards Spektakel (-DA), *Perry* 1136 (NBG); 8 miles east of Springbok (-DB), *Bruyns* 1732 (NBG); Springbok, *Marloth* 2412, 1413 (STE); Springbok, *Marloth* 6982 (STE, PRE); 58 km from Springbok towards Komaggas (-DC), *Perry* 1121 (NBG); Komaggas, *Duthie* 601 (STE).

—3017 (Hondeklipbaai): Kamieskroon (-BB), *Perry* 363 (NBG).

—3018 (Kamiesberg): 18 km west of Platbakkies (-AD), *Perry* 379 (NBG).

Eriospermum exilis P.L.Perry, sp. nov.; differt ab *E. deserticolum* et *E. pusillum* folio erecto glabro anguste lanceolato.

Plantae hysternanthae. *Tuber* pyriforme, 15–20 mm altum, 12 mm latum; caro alba; crescens acumen basale. *Folium* erectum; vagina folii, quae eodem tempore est, usque ad 10 mm supraterranea, filo metallico similis; lamina anguste lanceolata usque ad falcata, usque ad 95 mm longa, 4 mm lata, glauco-viridis, glabra. *Scapus* usque ad 140 mm longus, filo metallico similis; bractea pedunculata admodum visibilis supraterranea, membranacea. *Racemus* usque ad 75 mm longus, 14 mm latus, usque ad 16 floribus. *Bractee* 1 mm longae, membranaceae, carina atrobrunnea. *Pedicelli* usque ad 4 mm longi. *Perianthium* campanulatum; segmenta dimorpha, luteola, carina viridi; segmenta exteriora anguste elliptica, 4 mm longa, 1.5 mm lata, apicibus attenuatis retrorsisque; segmenta interiora spatulata, 4 mm longa, 2 mm lata, apice angusto attenuatoque, lateribus intro plicatis. *Stamina* segmentis celata, fila late lanceolata, 1 mm longa, adnata ad segmenta; antherae luteae. *Ovarium* globosum, 1.25 mm latum. *Stylus* minus quam 1 mm altus.

Type: South Africa, Cape Province, Karooport, fl. ex hort. Karoo Botanic Garden, January 1981 and 17th January 1983, *Perry* 949 (NBG, holotype; PRE, isotype). (Fig. 2).



FIG. 2.

Eriospermum exilis. 1. Flower, face view; 2. Flower bud; 3. Inflorescence; 4. Tuber and leaf, natural size; 5. Outer perianth segment and stamen; 6. Inner perianth segment and stamen; 7. Gynoecium. (Perry 949, NBG).

Plants hysteroanthous. *Tuber* solitary, pyriform, 15–20 mm high and up to 12 mm wide; skin thin and pale brown; flesh white; growing point basal. *Leaf* solitary, erect; old persistent sheaths 90 mm long, slender fibrous, greyish-brown; contemporary sheath exerted up to 10 mm, wiry, green to reddish glabrous; lamina very narrowly lanceolate to falcate, gradually tapering to the base, up to 95 mm long and 4 mm wide, glaucous green, glabrous, acuminate. *Scape* up to 140 mm long, wiry, less than 1 mm diameter, red at the base turning to green higher up; peduncular bract just exerted, transparent membranous with a reddish tip, amplexicaul except for the top, 1.5 mm. *Raceme* up to 75 mm long and 14 mm wide with up to 16 flowers. *Bracts* 1 mm long, transparent-membranous with dark brown keel. *Pedicels* lowest up to 4 mm when in flower, pale green. *Perianth* campanulate; segments dimorphic, pale yellowish with a green keel; outer segments narrowly elliptic, 4 mm long, 1.5 mm broad, with attenuate retrorse tips; inner spatulate becoming narrow-attenuate and folded inwards in the top half, 4 mm long, 2 mm broad. *Stamens* almost completely hidden by segments, filaments broadly lanceolate, 1 mm long, adnate to segments, yellowish-white; anthers yellow. *Ovary* globose, 1.25 mm across, pale green. *Style* less than 1 mm high, white.

Flowering time: January to March. Leafing period: April to October.

Distribution: this species is so far only known from a few scattered plants found in two localities, both on steep shady south east-facing slopes in damp pockets amongst quartzitic rocks. (Fig. 3b).

The long narrow erect leaf with wiry contemporary leaf sheath of this species could be mistaken for *E. graminifolium*; in which case it can be distinguished by the white flesh of the tuber as opposed to the red flesh in *E. graminifolium*. In flower these two species may be separated by the more compact inflorescence and shorter pedicels in *E. exilis*. On one of Marloth's herbarium sheets containing specimens of *E. flicale* there are two leaves from Tweedside. Although there are no flowers, the locality and shape of the leaves suggest that they actually belong to *E. exilis*.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): Karooport (-BC), *Perry* 949 (NBG). —3320 (Montagu): Tweedside (-AB), *Marloth* 12070 (PRE); Whitehill (-BA), *Perry* 957 (NBG).

Eriospermum pusillum P.L.Perry, sp. nov.: magnitudine parva omnium, lamina orbiculari cristis prominentibus longitudinalibusque, subtilibus floribus apicibus attenuatis in segmentis distinguatur.

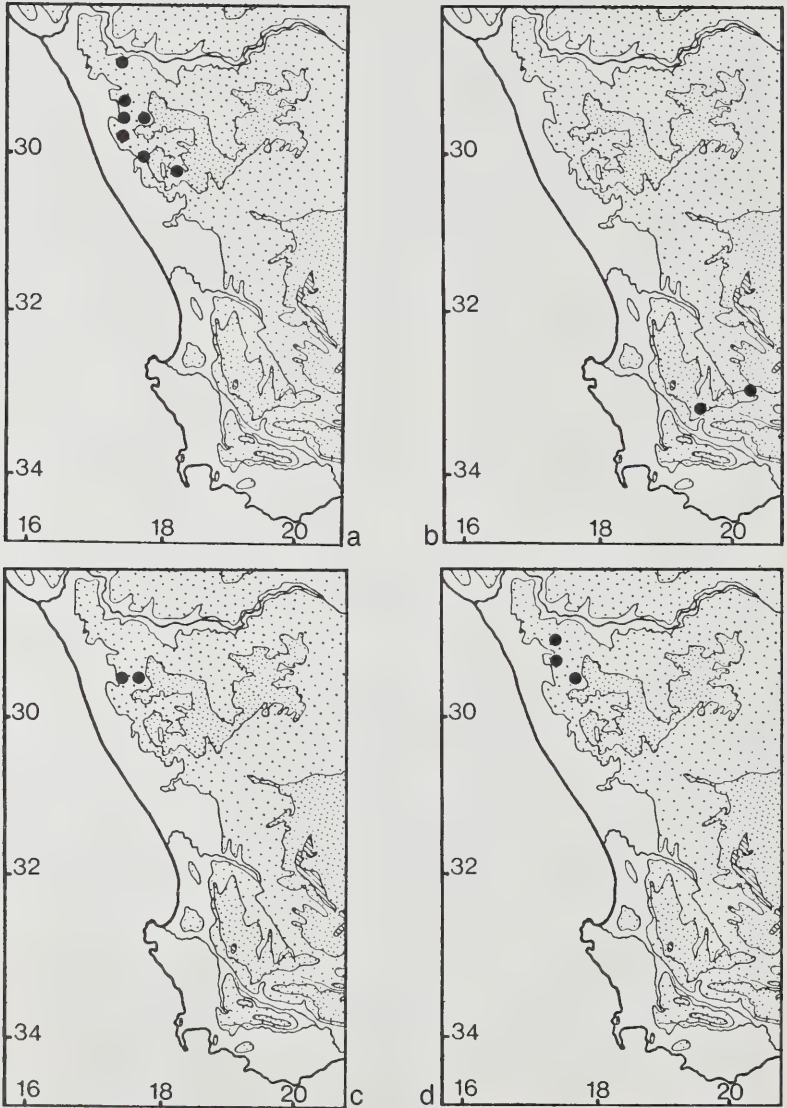


FIG. 3.
 (a) Distribution of *Eriospermum deserticolum*; (b) Distribution of *Eriospermum exilis*; (c) Distribution of *Eriospermum pusillum*; (d) Distribution of *Eriospermum filicaule*.

Plantae hysteranthae. *Tuber* irregulare, usque ad 17 mm longum, 10 mm diam.; caro alba; crescens acumen laterale. *Folium* solitarium, prostratum; vagina folii, quae eodem tempore est, haud exserta; lamina orbiculata cordata, usque ad 15 mm lata, 11 mm longa, glabra, cristis prominentibus longitudinalibusque. *Scapus* usque ad 50 mm longus, filo metallico similis; bractea pedunculata admodum visibilis supraterranea. *Racemus* laxus, usque ad 22 mm longus, 5–7 floribus. *Bracteae* saccatae vel cymbiformes, 1–2 mm longae, membranaceae carina rubri-brunnea. *Pedicelli* usque ad 3 mm longi. *Perianthium* calathiforme; segmenta dimorpha, connata secundum 1 mm ad basim, alba, carina viridirubra; segmenta exteriora 4 mm longa, 1,25 mm lata, elliptica, apicibus leviter attenuatis; segmenta interiora 3,5 mm longa, 1,5 mm lata, late spatulata, apicibus longis attenuatis intro plicatis. *Stamina* brevia, minus quam 1 mm longa, adnata ad segmenta per 1,5 mm; antherae rubro-purpureae. *Ovarium* globosum, 1 mm latum. *Stylus* minus quam 1 mm longus.

Type: South Africa, Cape Province, Hester Malan Nature Reserve, Springbok, ex hort. Karoo Botanic Garden, 18/12/1979, *Bruyns 1486* (NBG). (Fig. 4).

Plants hysteranthous. *Tuber* solitary, irregular, small, up to 17 mm long and 10 mm diameter; outer skin light brown; inner flesh white; growing point lateral. *Leaf* solitary, old persistent leaf sheaths fibrous, up to 80 mm long; contemporary sheath barely exserted; lamina prostrate, orbicular-cordate, up to 15 mm broad and 11 mm long, green, glabrous with prominent longitudinal ridges, dried leaf persistent till flowering. *Scape* up to 50 mm long and 0.5 mm diameter, red at the base, shading to pale green above; peduncular bract just reaching ground level, surrounded and hidden by old sheathing bases, very thin-membranous, non-amplexicaul part acute, 1,5 mm, purplish. *Raceme* lax, up to 22 mm long, 5–7-flowered. *Bracts* saccate or cymbiform, 1–2 mm long membranous-white with reddish-brown keel. *Pedicels* ascending, up to 3 mm long, white. *Perianth* cup-shaped; segments dimorphic, connate for 1 mm at the base, white with green keel sometimes overlaid with faint red streaking; outer segments 4 mm long and 1,25 mm wide, elliptic with extended base and slightly attenuate tips; inner segments 3,5 mm long and 1,5 mm at widest part, broadly spatulate with long attenuate tips folded inwards. *Stamens* short; filaments less than 1 mm long, broader at the base and tapering towards the anther, arising 1,5 mm up the inner segments; anthers reddish-purple. *Ovary* globose, 1 mm long and 1 mm broad. *Style* less than 1 mm long, white. Copious nectar produced at the base of the ovary.

Flowering time: December to February. Leafing period: April to October.

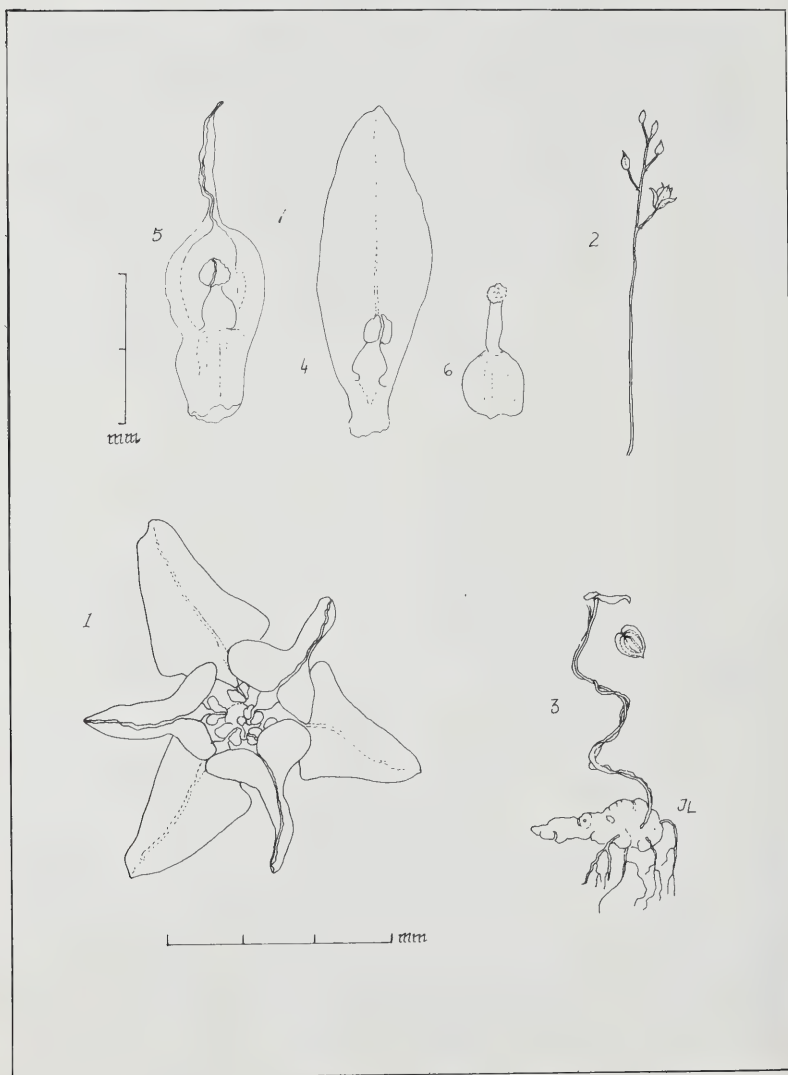


FIG. 4.

Eriospermum pusillum. 1. Flower, face view, 2. Inflorescence, natural size; 3. Tuber and leaf, natural size; 4. Outer perianth segment and stamen; 5. Inner perianth segment and stamen; 6. Gynoecium. (Perry 1137, NBG).

Distribution: *E. pusillum* is found in moist shaded areas in rich gravelly soil amongst rock and low karroid bushes. To date it has only been found in two areas near Springbok but the small round leaf could easily be missed among other green ground foliage and it may prove to be more widespread. (Fig. 3c).

This species is distinguished by the consistent small size of all its parts. The ridged effect on the tiny orbicular leaf is characteristic. The few-flowered delicate inflorescence and flowers with white perianth segments help to distinguish it from its closest relatives *E. deserticum* and *E. exilis*.

SPECIMENS EXAMINED

CAPE PROVINCE—2917 (Springbok): 6 km east of the top of Spektakel Pass (-DA), Müller-Doblies 79097 (NBG); 20 km west of Springbok towards Spektakel, Perry 1137 (NBG, PRE); Hester Malan Nature Reserve (-DB), Bruyns 1486 (NBG).

Eriospermum filicaule Marloth ex P. L. Perry, sp. nov.; differt a speciebus omnibus aliis inflorescentia laxa, pedicellis filo metallico similibus flexuosisque, dimensionibus florum parvorum. Regio puberula ad basim vaginae folii, quae eodem tempore est, atque ad basim scapi inter species alias non invenitur.

Plantae hysternanthae. *Tuber* irregulare, usque ad 20 mm latum; caro subrosea; crescens acumen laterale. *Folium* erectum; vagina folii, quae eodem tempore est, circa 70 mm supraterranea, rubella, trichomatibus latissimis albisque ad basim, altius viridis et glabra; lamina lanceolata usque ad 55 mm longa, 9 mm lata, viridis, glabra, tenuis. *Scapus* usque ad 90 mm longus, filo metallico similis, atroruber, puberulous ad basim, altius viridis glaberque, parum incrassatus infra pedicellum primum. *Racemus* laxissimus, flexuosus, 10–20 floribus. *Bracteae* lanceolatae, auctae, 1 mm longae, membranaceae. *Pedicelli* erecto-patentes, arcuati, infimi usque ad 85 mm longi, supremi 10 mm, filo metallico similissimi. *Perianthium* parvum, segmenta dimorpha, alba, carina viridi-rubra; segmenta exteriora expansa, anguste elliptica, 3,5 mm longa, 1,25 mm lata; segmenta interiora erecta, late spatulata, 2,5–3 mm longa, 2 mm lata, parum fimbriate, coartata in apicibus. *Stamina* paene longa quam segmenta perianthii; fila exteriora late lanceolata, interiora adnata ad segmenta per plus quam 1 mm, pars libera abrupte decrescens; antherae viridi-caeruleae. *Ovarium* vix 1 mm globosum, viride. *Stylus* vix 1 mm longus, cylindricus albus.

Type: South Africa, Cape Province, 1 km west of Steinkopf, ex hort. Karoo Botanic Garden, 17/03/1982, Perry 1048 (NBG). (Fig. 5).

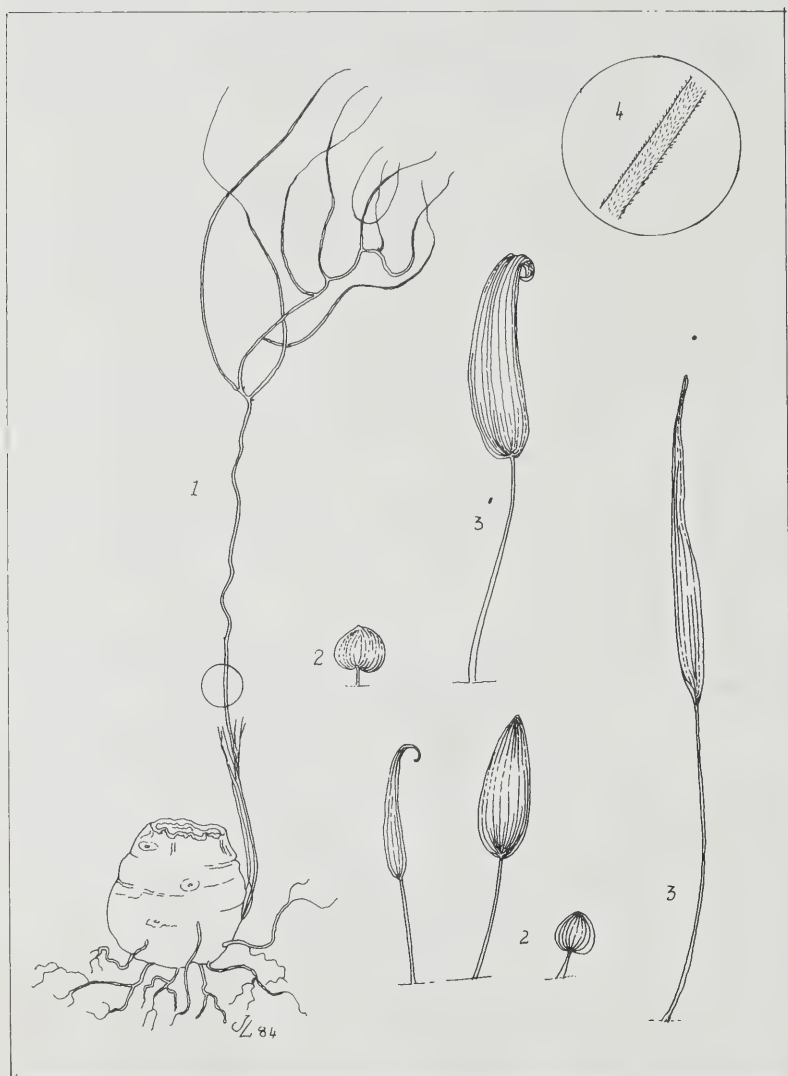


FIG. 5.

Eriospermum filicaule. 1. Tuber and inflorescence drawn from herbarium specimen; 2. Leaf from immature plant; 3. Leaf from mature plant. 4. Portion of base of scape magnified. (Müller-Doblies 79216, NBG).

Plants hysteroanthous. *Tuber* roundish to irregular, up to 20 mm across; skin thin, light brown; flesh soft and juicy, pale pink in the older part; growing point basal with a lateral groove. *Leaf* solitary, erect; old persistent sheathing bases up to 60 mm long, membranous, chestnut-brown to greyish; contemporary leaf sheath exerted approximately 70 mm, up to 1 mm diameter, reddish with short white trichomes at the base, gradually becoming green and glabrous towards the lamina; lamina lanceolate up to 55 mm long and 9 mm wide, bright green, glabrous on both surfaces, shiny on the lower surface, mat on the upper surface, thin-textured. *Scape* up to 90 mm long, very wiry, dark red and puberulous at its base, becoming green and slightly thicker a few millimetres below the first pedicel. *Raceme* very lax, flexuose, 10–20 flowers. *Bracts* lanceolate-acute, 1 mm, membranous. *Pedicels* erectopate, arcuate, lowest up to 85 mm long, upper 10 mm, green, very wiry. *Perianth* small; segments dimorphic, white with a green keel and some red streaking; outer segments spreading, narrow elliptic-acute, 3.5 mm long; inner segments erect, broadly spatulate, 2.5–3 mm long, slightly fimbriate with pinched-in tips. *Stamens* nearly as long as perianth segments; outer filaments ovate-acute to broadly lanceolate, inner adnate to segments for more than 1 mm, free part narrowing abruptly; anthers turquoise. *Ovary* globose, 0.75 mm–1 mm, green. *Style* cylindrical, 0.75 mm–1 mm long, white. *Cap-sule* clavate.

Flowering time: March. Leafing period: April to October.

Distribution: *E. filicaule* is not common and so far has been found only in a limited area around Steinkopf in flat stony ground among karroid bushes. (Fig. 3d).

The inflorescence of *E. filicaule* is very distinctive from all other species because of its lax and very wiry flexuose appearance and small flowers. The pilose region at the base of the scape and also at the base of the contemporary leaf sheath are also good distinguishing characters. The leaf is similar in shape to the adult leaves of *E. deserticum* which is found in the same district. The latter however, invariably produces rhizomes and so is usually found in larger colonies with smaller leaves of different shapes. The hairs on the contemporary leaf sheath are also much longer in *E. deserticum*.

SPECIMENS EXAMINED

CAPE PROVINCE—2917 (Springbok): Between Steinkopf and Anenous Pass (-BA), Müller-Doblies 79 216 (NBG); 1 km west of Steinkopf (-BC), Perry 1048 (NBG); Near Steinkopf, Marloth 6432, 6452, 6552, 6525 (PRE); Springbok (-DB), Herre 2415 (PRE).

Eriospermum minutiflorum Marloth ex P. L. Perry, sp. nov.; differt a speciebus omnibus aliis flore parvo globosoque atque pedicello incrassato

sub flore. Differt ab *E. parvifolium* tubere formae irregularis atque carnis rubrae.

Plantae hysternanthae. *Tuber* irregulare, circa 25 mm altum, 50 mm latum; caro rubra; crescens acumen basale. *Folium* erectum; vagina folii, quae eodem tempore est, usque ad 10 mm supraterranea; lamina ovata vel elliptica, usque ad 70 mm longa, 55 mm lata; superficies ambae glauco-virides, glabrae, aliquantum coriaceae. *Scapus* usque ad 100 mm longa, 1 mm diam.; bractea pedunculata vix visibilis supraterranea, membranacea, apice interdum rubello retrorsoque. *Racemus* usque ad 140 mm longus, 15 mm latus, 16–30 floribus. *Bractae* deltatae, vix 1 mm longae. *Pedicelli* usque ad 6 mm longi, erecto-patentes florescentia, erectiores fructificantes incrassati ad basim floris. *Perianthium* globosum, saepe vix aperiens; segmenta subaequalia, albida, carina atrovirenti; segmenta exteriora elliptica, 2,5 mm longa, 1,5 mm lata; segmenta interiora late spatulata, apice leviter coartato et crenutato, 2 mm longa, 1,8 mm lata. *Stamina* adnata ad basim segmentorum; fila subaequalia, late ovata, complanata, 1 mm longa, 1 mm lata, antherae albae. *Ovarium* globosum, 1 mm latum, viride, maculis bruneis. *Stylus* 1 mm longus.

Type: South Africa, Cape Province, Grootvlei Pass, fl. ex hort. Karoo Botanic Garden, 10/05/1980, *Perry 1130* (NBG, holotype; K, PRE, MO, isotypes). (Fig. 6).

Plants hysternanthous. *Tuber* solitary, irregular, approximately 25 mm high and 50 mm across; outer skin pale brown; inner flesh pale pink in the younger part, becoming beetroot-red in the older part; growing point basal. *Leaf* solitary, erect, old persistent leaf sheaths up to 150 mm long, greyish-brown, fibrous; contemporary leaf sheath exerted up to 10 mm, 1 mm diameter, white or dark reddish to reddish-pink, glabrous; lamina, ovate or elliptic, up to 70 mm long and 55 mm wide; glaucous green both surfaces, glabrous, somewhat leathery; margin entire, undulate; base obtuse, apex apiculate. *Scape* up to 100 mm long and 1 mm diameter; dark purple streaked with a greyish bloom higher up; peduncular bract barely exerted above ground, membranous, amplexicaul except for top 3 mm, acute, sometimes reddish and retrorse. *Raceme* up to 140 mm long and 15 mm across with 16–30 flowers. *Bracts* deltate, barely 1 mm long, membranous-white with a brown midrib, lower ones spurred, surrounding the base of the pedicels. *Pedicels* up to 6 mm long, erecto-patent in flower becoming more erect and close to the rachis in fruit, covered with a greyish bloom, thickened towards the base of the flower. *Perianth* globose, often barely opening; segments subequal, whitish with dark green keel overlaid with red streaking, especially on the underside; outer segments elliptic, 2,5 mm long and 1,5 mm wide, apex acute; inner segments broadly spatulate or almost orbicular,



FIG. 6.

Eriospermum minutiflorum. 1. Flower, face view; 2. Flower and pedicel, side view; 3. Inflorescence; 4. Tuber and leaf, natural size; 5. Outer perianth segment and stamen; 6. Inner perianth segment and stamen; 7. Gynoecium. (Perry 1130, NBG).

apex slightly pinched in and frilled, 2 mm long and 1.8 mm wide. *Stamens* adnate to the base of segments; filaments subequal, broadly ovate, flattened, 1 mm long and 1 mm wide at the base; inner very slightly narrower than outer; white or reddish-purple, fleshy; anthers white. *Ovary* globose, 1 mm \times 1 mm, pale green with small reddish-brown blotches. *Style* cylindrical, barely 1 mm, cream.

Flowering time: March–May. Leafing period: April–October.

Distribution: *E. minutiflorum* appears to have a very limited distribution in the Grootvlei and Bitterfontein area of Namaqualand. It has been found in dry clayey soil in a flattish area among bushes such as *Rhus* sp. and *Lebeckia* sp., and where geophytes are numerous. (Fig. 8a).

In flower this species is easily recognisable as it differs in several respects from all other known species. The small globose flower and thickening of the pedicel, where it supports the flower, are particularly characteristic. In leaf *E. minutiflorum* could be mistaken for *E. parvifolium*, which has a similar shaped erect leaf, although the lower surface of the lamina in *E. parvifolium* tends to be much lighter in colour than the upper surface, whereas in *E. minutiflorum* there is no colour distinction between the two surfaces. However, to be certain of identification in the vegetative stage it is necessary to study the tubers of the two species which are quite distinct, *E. parvifolium* having a globose, white fleshed tuber with apical growing point and *E. minutiflorum* an irregular shaped, red-fleshed tuber with basal growing point.

Several manuscript names were used by Marloth and Duthie for this species. Marloth chose the name *E. minutiflorum* for his 13710. Duthie considered her No. 635 to be a distinct species and first suggested the name *E. parviflorum* as being appropriate. Later the name *E. micranthum* was suggested because she felt the name *E. parviflorum* might lead to confusion with *E. parvifolium*. Duthie's *E. micranthum* and Marloth's *E. minutiflorum* are clearly the same species and here the name *E. minutiflorum* is adopted for this newly described species.

SPECIMENS EXAMINED

CAPE PROVINCE—3017 (Hondeklipbaai): 4.7 km east of farm, Grootvlei Pass (-BB), *Perry* 1130 (NBG).

—3118 (Van Rhynsdorp): Bitterfontein (-AB), *Marloth* 13710 (PRE, STE); Namaqualand, *Duthie* 635, 637 (STE).

Eriospermum flabellatum Marloth ex P. L. Perry sp. nov.; differt ab *E. bowieanum* vagina folii brunnea, longiori, filo metallico similiore, quae eodem tempore est, atque tuberibus gracilioribus, nitentibus, perviridibus, facialibus.

Plantae hysteranthae. *Tuber* irregulariter formatum, usque ad 45 mm latum, 25 mm altum; caro rubra; crescens acumen basale usque ad laterale. *Folium* appendicibus erectis facialibus; vagina folii, quae eodem tempore est, 40 mm supraterranea, filo metallico similis, laete brunnea, glabra; lamina multum deminuta, ovata, cordata, usque ad 6 mm lata, atrovirens, margine revoluta; superficies tecta tuberibus circa 20 numero, anguste teres, 2–4 ramis in dimidio superiore, usque ad 20 mm longa, atrovirens. *Scapus* 18 mm longus, filo metallico similis. *Racemus* compactus usque ad 8 mm, circa 8 floribus. *Bracteae* deltatae, 1 mm longae, membranaceae, carina brunnea. *Pedicelli* 2,5 mm longi. *Perianthium* calathiforme; segmenta dimorpha, 5 mm longa, paene 2 mm lata, alba, carina viridi-brunnea; segmenta exteriora leviter effusa, elliptica; segmenta interiora erecta, apices leviter crenati. *Stamina* subaequalia; fila late lanceolata, interiora longiora quam exteriora; antherae luteae. *Ovarium* globosum, 1,5 mm latus. *Stylus* 1 mm longus.

Type: South Africa, Cape Province, 18 km from Laingsburg towards Ladismith, fl. ex hort Karoo Botanic Garden, April 1979, *Bayer 515* (NBG). (Fig. 7).

Plants hysteranthous. *Tuber* solitary, irregularly shaped, up to 45 mm wide and 25 mm high; skin light brown; flesh red; growing point basal to lateral. *Leaf* solitary; old persistent leaf sheaths up to 80 mm long, greyish-brown; contemporary leaf sheath exerted 40 mm, wiry, 0.5 mm diameter, light brown, glabrous; lamina greatly reduced, ovate or orbicular-cordate, up to 6 mm across, dark green, glabrous, margin revolute; upper surface covered with enations about 20 in number, narrowly terete with 2–4 branches in the upper half, up to 20 mm long, dark green. *Scape* 18 mm long, wiry, 0.5 mm diameter with about 8 flowers. *Bracts* deltate, attenuate, 1 mm long, membranous, brown-keeled, half amplexicaul. *Pedicels* 2.5 mm long in flower, glabrous. *Perianth* cup-shaped; segments dimorphic, 5 mm long and nearly 2 mm wide, white with green keel and red flecked; outer segments slightly spreading, elliptic; inner segments erect with slightly crimped tips. *Stamens* subequal; filaments broadly lanceolate, outer 1.75 mm long and barely 1 mm at the widest part, inner 2.5 mm long and more than 1 mm at the widest part; anthers yellow. *Ovary* globose, 1.5 green. *Style* 1 mm long, white.

Flowering time: April. Leafing period: April to October.

Distribution: *E. flabellatum* is not a common species and appears to have a limited distribution in areas around Laingsburg in the southern part of the great Karoo. It grows in dry stony areas where succulents and karroid bushes are found. (Fig. 8c).

The facial appendages and small inflorescence make *E. flabellatum* clearly distinguishable from all other species with the exception of *E. bowieanum*

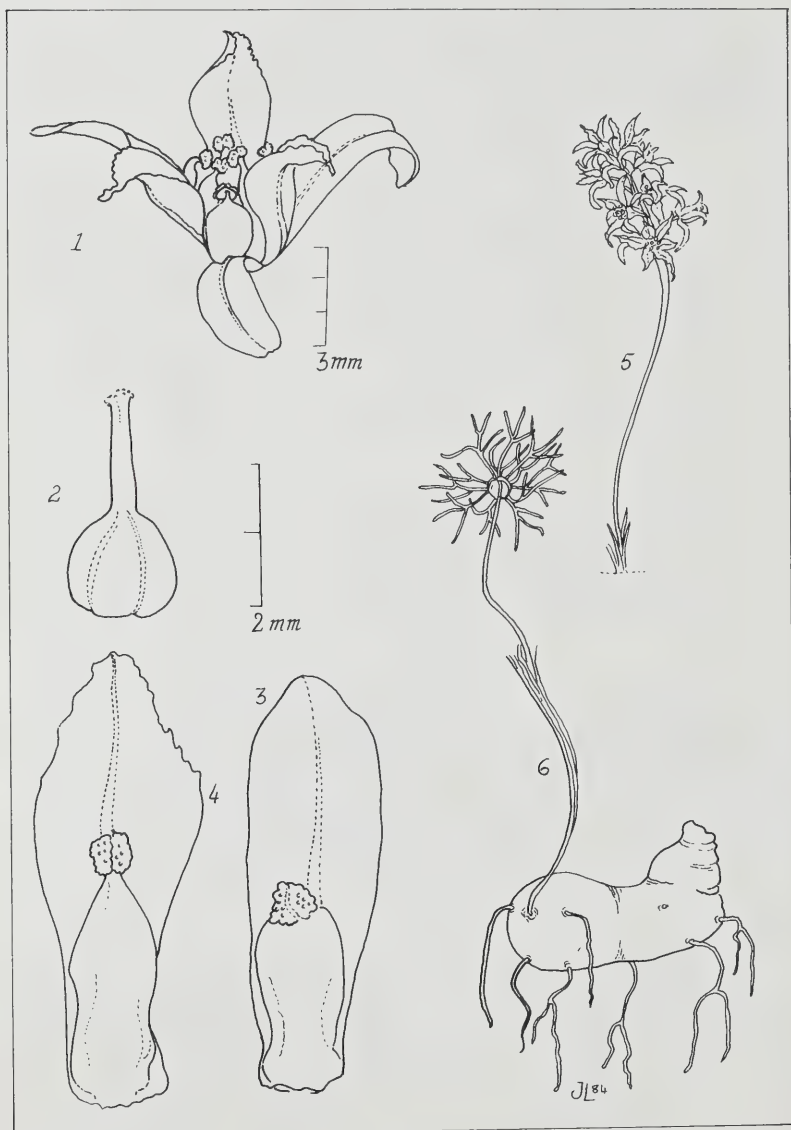


FIG. 7.

Eriospermum flabellatum. 1. Flower, side view; 2. Gynoecium; 3. Outer perianth segment and stamen; 4. Inner perianth segment and stamen; 5. Inflorescence; 6. Tuber and leaf, natural size. (Bayer 2971, NBG).

which it closely resembles. However, detailed study shows several differences. *E. flabellatum* has a longer and more wiry contemporary leaf sheath which is light brown in colour as opposed to the thicker white sheath of *E. bowieanum*. The facial appendages are more consistent in length, more slender and a dark shiny green in *E. flabellatum*, not dull glaucous green as in *E. bowieanum*. The tuber of *E. flabellatum* is more variable in shape with a lateral or basal growing point. The inflorescence is not spicate as in *E. bowieanum* and individual flowers are larger with segments at least 1 mm longer and pedicels 1.5 mm longer.

Marloth described another similar species, *E. coralliferum* in *South African Gardening and Country Life* (1929), from leaves and tubers collected in the Robertson Karoo, by Hurling and Neil. These two species have been discussed fully by Duthie (1940) when she concludes that Marloth's *coralliferum* is identical with Baker's *E. bowieanum*. At the same time Marloth's

script name *E. flabellatum*. This Duthie also suggests is a form of *E. bowieanum* with more slender processes. However, having seen several living collections, *E. flabellatum* appears to be a distinct but closely related species. collection 14121, from Barrydale, is mentioned, to which he gave the manu-

SPECIMENS EXAMINED

CAPE PROVINCE—3220 (Sutherland): 44 miles north of Laingsburg (-DC or -DD), *Acocks 14319* (PRE).
—3320 (Montagu): 18 km from Laingsburg towards Ladismith (-DB), *Bayer 515* (NBG); Kareevlakte, *Compton 8785* (NBG); Barrydale (-DC), *Marloth 14121* (PRE).

Eriospermum namaquanum Marloth ex P. L. Perry, sp. nov.; a speciebus aliis inflorescentia eius subcorymbosa, floribus maximis segmentis perianthii recurvis, distinguitur.

Plantae hysternanthae. *Tubera* multiplicia, usque ad 25 mm alta, 45 mm lata; pellis coriacea atque maculota; caro flavido-alba; radices orientes annulo prope basim; crescens acumen apicale. *Folium* semierectum; vagina folii, quae eodem tempore est, 20–50 mm supraterranea, supra sulcata; lamina ovata, usque ad 70 mm longa, 1.5 mm diam., carnosa usque ad coriaceum, glabra. *Scapus* usque ad 65 mm longus, 1.5 mm diam; bractea pedunculata 5–6 mm supraterranea, ovata, apiculata, viridis evadescens membranacea. *Racemus* laxus, subcorymbosus, 20–50 mm longa, 45 mm latus, 7–12 floribus. *Bracteae* deltatae, saccatae, 2 mm longae, membranaceae, albae, carina rubra. *Pedicelli* infimi usque ad 20 mm longi. *Perianthium* effusum usque ad recurvum, usque ad 20 mm latum; segmenta aequalia anguste elliptica, 11 mm longa, 3 mm lata, alba, carina viridi-rubra. *Stamina* erecta, aequalia; fila peranguste lanceolata, 5 mm longa, 1.5 mm lata, alba; antherae luteae.

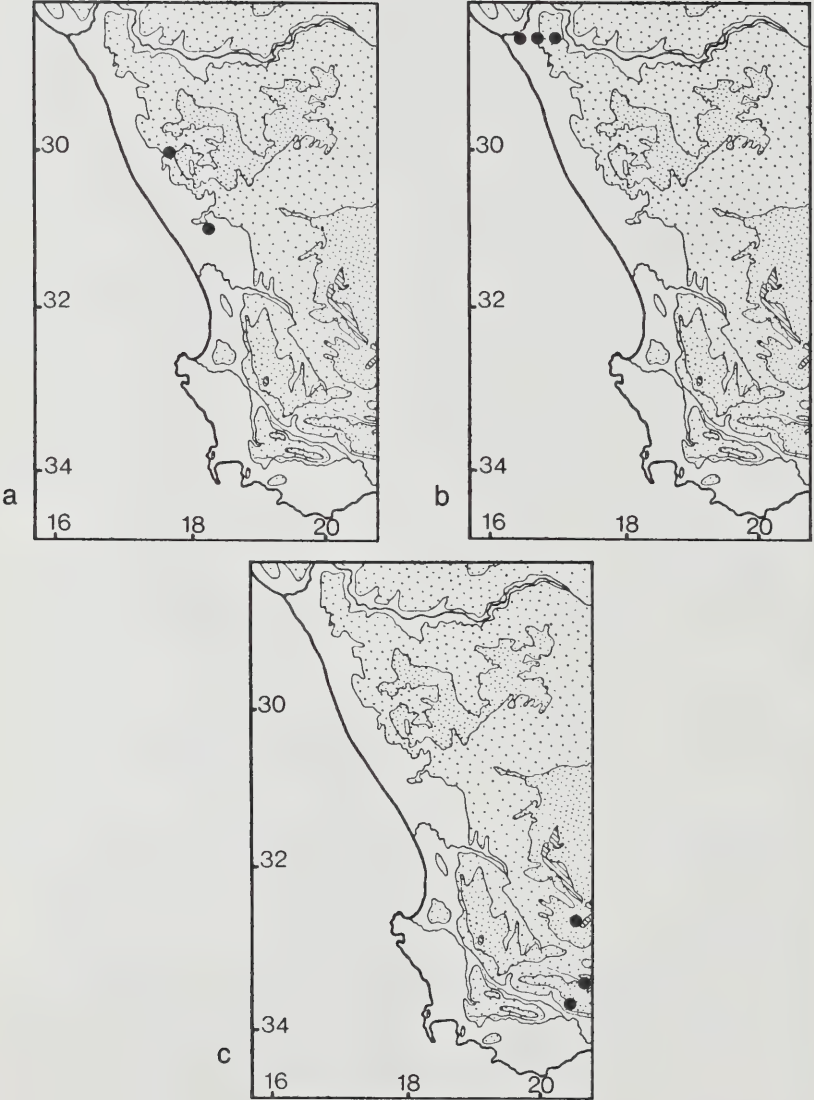


FIG. 8.

(a) Distribution of *Eriospermum minutiflorum*; (b) Distribution of *Eriospermum namaquanum*; (c) Distribution of *Eriospermum flabellatum*.

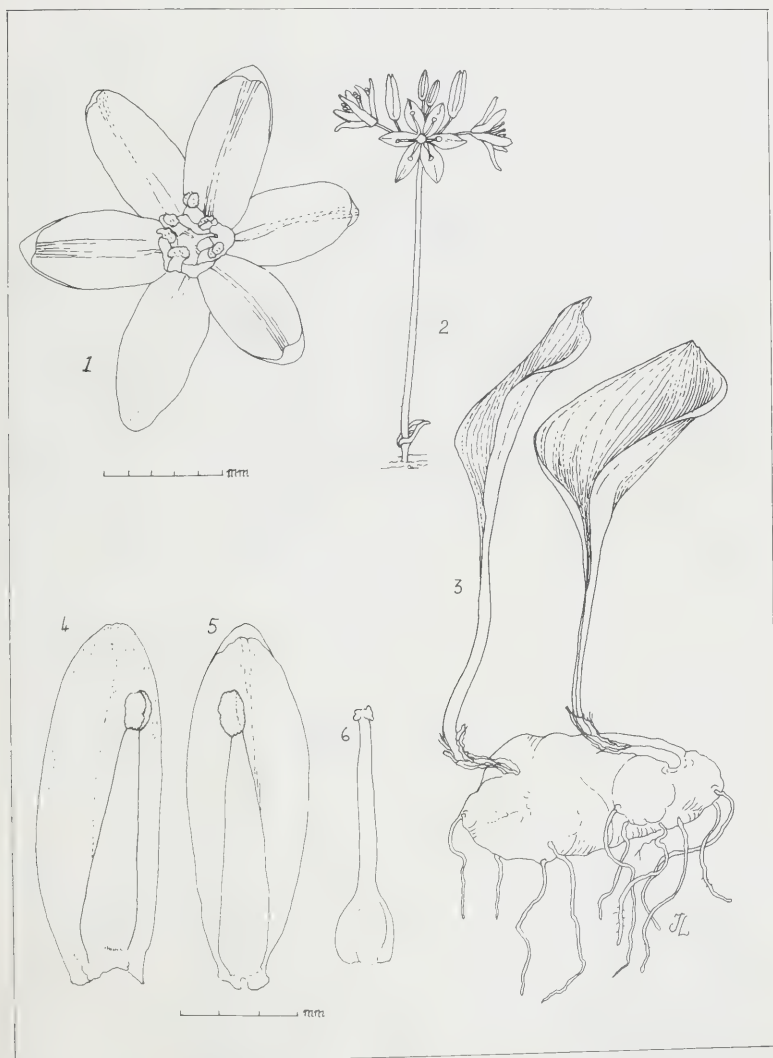


FIG. 9.

Eriospermum namaquanum. 1. Flower, face view; 2. Inflorescence; 3. Tuber and leaves, natural size; 4. Outer perianth segment and stamen; 5. Inner perianth segment and stamen; 6. Gynoecium. (Bayer 1025, NBG).

Ovarium ovoideum, 2 mm altum, 1,5 mm latum, album. *Stylus* 3 mm longus.

Type: South Africa, Cape Province, Richtersveld, Dolomite Peaks, fl. ex hort. Karoo Botanic Garden, 10/3/1980, *Perry 1081* (NBG, holotype; PRE, isotype). (Fig. 9).

Plants hysteroanthous. *Tubers* multiple, formed from several individual tubers joined together, up to 25 mm high and 45 mm across; skin pale greyish-brown with a mottled appearance when dried, coriaceous; flesh yellowish-white; roots arising in a ring near the base; growing point apical. *Leaf* solitary; semi-erect; old persistent sheaths 90 mm long and 8 mm across, widening to 15 mm near ground level, membranous, light greyish-brown; contemporary leaf sheath exerted 20–50 mm, grooved so that the base of the lamina is folded in on the upper side, white at the base becoming green above; lamina ovate, up to 70 mm long and 50 mm at its widest, green both surfaces, fleshy to coriaceous, glabrous, conspicuous close longitudinal veins especially on the underside, margin entire. *Scape* up to 65 mm long and 1,5 mm diameter, greyish-green with faint red spotting, glabrous; peduncular bract exerted 5–6 mm above ground, ovate-apiculate, green becoming membranous. *Raceme* lax, almost corymbose, 20 to 50 mm long and 45 mm across, 7–12 flowers. *Bracts* deltate, saccate, semi-amplexicaul, 2 mm long, membranous-white with red keel and spotting. *Pedicels*, lowest up to 20 mm long. *Perianth* spreading to recurved, up to 20 mm across; segments equal, narrowly elliptic, 11 mm long and 3 mm wide, joined at the extreme base only, white with a green keel and faint red streaking. *Stamens* erect, equal, outer and inner nearly the same height; filaments very narrowly lanceolate, 5 mm long and 1,5 mm wide at the base, tapering to 0,5 mm where the anthers are joined, white; anthers dorsifixed, introrse, yellow. *Ovary* ovoid, 2 mm high and 1,5 mm at its widest, white. *Style* 3 mm long, slightly twisted, white.

Flowering time: February–March. Leafing period: April to October.

Distribution: *E. namaquanum* appears to be restricted to the western part of the Richtersveld where it is found in the sandy flats and extending into the rocks of the Dolomite Peaks. Populations in these areas are comparatively large. (Fig. 8b).

This species should not easily be confused with any other taxon from a similar locality. The white reflexed flowers are extra large for the genus and nearest to them would be the flowers of *E. paradoxum*, in which case the more compact inflorescence and less reflexed flowers make them distinct. In leaf it is nearest to *E. parvifolium* and is most easily separated from that species by the tough mottled skin of the tuber.

SPECIMENS EXAMINED

CAPE PROVINCE—2816 (Oranjemund): Arrisdrif, Richtersveld (-DA), Hall 622 (NBG); Beauvalon, Williamson 2945 (BOL); 2 km east of Beauvalon, Bayer 1025 (NBG); Kortdoringberg, Alexander Bay, van Jaarsveld 5427 (NBG); Camp south of Doornpoort (-DB), Marloth 12305 (PRE). —2817 (Vioolsdrif): Dolomite Peaks (-CA), Perry 1081 (NBG); Dolomite Peaks, Mitchell 369 (NBG).

Eriospermum breviscopum Marloth ex P. L. Perry, sp. nov.; *E. zeyheri* affinis, sed separatus longitudine scapi magnopere redacta, racemo compacto conicoque, floribus albis.

Plantae hysterathae. *Tubera* pyriformia vel oblonga, usque ad 75 mm × 30 mm; caro alba; crescens acumen basale usque ad oblongum. *Folium* prostratum; vagina folii, quae eodem tempore est, haud exserta; lamina orbiculata cordata, usque ad 80 mm lata, 60 mm ex apice ad lobos, clare viridis, leviter carnosa, glabra. *Scapus* usque ad 30 mm longus, 2 mm diam., glaber; bractea pedunculata admodum visibilis supraterranea, succulenta, clare viridis, evadescens membranaceae. *Racemus* compactus, anguste conicus, usque ad 80 mm longus, 20 mm latus, usque ad 100 floribus. *Bracteae* deltatae, usque ad 1 mm longae vel obsoletae, albae. *Pedicelli* 3–6 mm longi. *Perianthium* rotatum, dulciter odoratum; segmenta subaequalia, alba, carina viridirubra; segmenta exteriora 4 mm longa et 2 mm lata, interiora 5 mm longa et 2 mm lata. *Stamina* erecta, conniventia, annulum facientia circa ovarium; fila oblonga, complanata, 2 mm longa, 1,5 mm lata, apiculata, alba; antherae luteae. *Ovarium* globosum, 1,25 mm lata, viride. *Stylus* 1 mm longus.

Type: South Africa, Cape Province, 13,3 km east of Bonnievale railway line, just west of Drew, fl. ex hort. Karoo Botanic Garden, March 1978, Perry 132 (NBG). (Fig. 10).

Plants hysteranthous. *Tubers* solitary, pyriform to horizontally oblong, up to 75 mm × 30 mm; skin tough, light brown, flesh white; growing point basal to lateral. *Leaf* solitary, prostrate; old persistent sheaths up to 80 mm long and 10 mm diameter, greyish-brown, membranous; contemporary leaf sheath not exserted; lamina firmly adpressed to the ground, orbicular-cordate, up to 80 mm across and 60 mm from apex to lobes and 45 mm apex to depression, bright green both surfaces, sometimes reddish below, slightly fleshy, glabrous, margin entire. *Scape* erect, rigid, up to 30 mm long and 7 mm diameter, faintly red-streaked, glabrous; peduncular bract just visible above ground, succulent, bright green becoming brown, membranous with red on margin and apex margins involute, tip acute to attenuate. *Raceme* compact, narrowly conical, up to 80 mm long and 20 mm across with up to 100 flowers. *Bracts* triangular, up to 1 mm long or obsolete, white. *Pedicels*

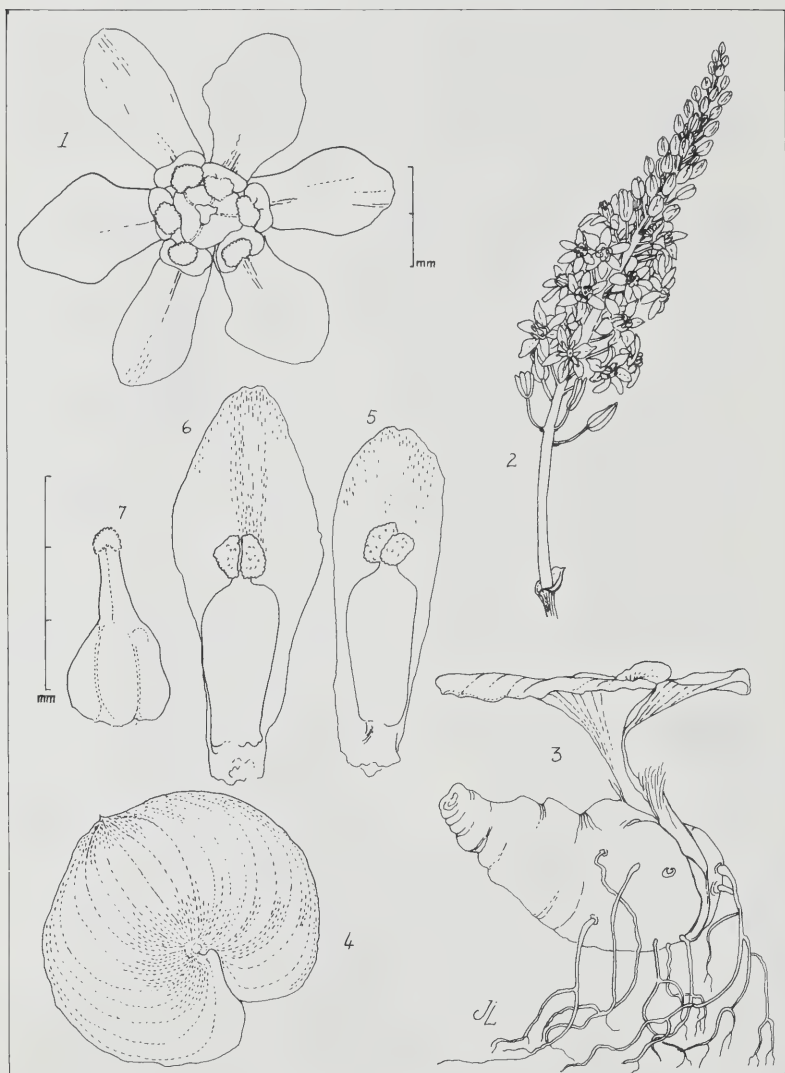


FIG. 10.

Eriospermum breviscopum. 1. Flower, face view; 2. Inflorescence, natural size; 3. Tuber and leaf, side view; 4. Leaf, from above. 5. Outer perianth segment and stamen; 6. Inner perianth segment and stamen; 7. Gynoecium. (Bohnen 7816, NBG).

lower 3–6 mm in flower, becoming shorter above, red-streaked. *Perianth* rotate, sweetly scented; segments subequal, white with a green keel and red streaks on the underside, reddish-purple at the apex; outer segments 4 mm long and 2 mm wide, inner 5 mm long and 2 mm wide. *Stamens* erect, connivent, forming a ring round the ovary; filaments spatulate, flattened, 2 mm long and 1.5 mm at the widest part near the top, apiculate, white; anthers yellow, versatile. *Ovary* globose, 1.25 mm across, green. *Style* cylindrical, 1 mm long, greenish-yellow.

Flowering time: February to March. Leafing period: April to October.

Distribution: *E. breviscapum* is frequent in the Worcester–Robertson Karoo, where it appears to be confined to the flat areas on clayey, sometimes stony, soil. (Fig. 13a).

E. breviscapum is very closely related to *E. zeyheri*, having the same distinctive rotate-shaped flower with erect stamens forming a ring round the ovary. It is separated from that species by the great reduction in length of the scape, the compactness of its raceme and the white perianth segments. The orbicular, prostrate leaf and white-fleshed tuber make the two species indistinguishable in the vegetative stage. At present they can be separated on locality, *E. zeyheri* being an eastern Cape species and *E. breviscapum* having a more limited distribution in the western Cape.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): Chavonnes (-CB), *Perry* 206 (NBG); Brewelskloof, *Perry* 214 (NBG); Brandwag building plots, *Perry* 1387 (NBG); Near main picnic site on the Worcester to Robertson road, *Perry* 271 (NBG); Old Golf Course, Worcester, *Duthie* 699 (STE); Lemoenpoort (-CD), *Perry* 681 (NBG); Robertson district (-DD), *Duthie* 555, 556, 574 (STE).
—3320 (Montagu): Drew (-CC), *Perry* 132 (NBG).
—3420 (Bredasdorp): Swellendam (-AB), *Perry* 730 (NBG); de Hoop (-AD), *Snijman* 115 (NBG).

Eriospermum descendens Marloth ex P. L. Perry, sp. nov.; *E. zeyheri* affinis, sed separatus multitubere, auctibus externis crassis rhizomatosi, caespes foliorum simul multorum formantibus.

Plantae hysternanthae. *Tubera* multiplicia, auctibus externis crassis rhizomatosi, massam 150 mm vel plus et aliquando descendentem ad 100 mm latam formantibus; pellis coriacea; caro flava alba, crescens acumen laterale. folium prostratum; vagina folii, quae eodem tempore est, haud exserta; lamina orbiculata cordata, usque ad 85 mm lata, 60 mm ex apice ad depressionem, viridis, glabra, carnosae. *Scapus* 60 mm longus et 2 mm diam; bractea pedunculata admodum visibilis supraterranea, alba apice rubro. *Race-*

mus compactus, anguste conicus, usque ad 90 mm longus, circa 40 floribus. *Bractee* vestigiales, albae. *Pedicelli* 4 mm longi, patentes. *Perianthium* rotatum, 10 mm latum; segmenta subaequalis, spathulata, exteriora 4 mm long et 1,5 mm lata, interiora 5 mm longa et 2 mm lata, crenea, carina viridibrunnea. *Stamina* erecta, annulum facientia circa ovarium; fila oblonga, apiculata, exteriora 1,75 mm longa et 1,25 mm lata, interiora leviter longiora et angustiora, alba. *Ovarium* globosum, 1,5 mm altum, 1,5 mm latum, viride. *Stylus* 1 mm longus.

Type: South Africa, Cape Province, Van Rhynsdorp, Farm Atties, fl. ex hort. Karoo Botanic Garden, 19/3/1980, *Perry 1021* (NBG, holotype; K, PRE, isotypes). (Fig. 11).

Plants hysteranthous. *Tubers* multiple due to thick rhizomatous outgrowths forming solid clumps 150 mm or more across and sometimes descending to 100 mm; outer skin thick-coriaceous, light grey-brown; inner flesh yellowish-white; growing point lateral. *Leaf* one per growing point, prostrate; old persistent sheaths up to 90 mm long and 7 mm across, pale brown, membranous; contemporary leaf sheath not exerted beyond the persistent bases; lamina firmly adpressed to the ground, orbicular, deeply cordate with lobes sometimes overlapping, up to 85 mm across and 60 mm from the apex to the depression where the leaf sheath arises, green, glabrous, fleshy, longitudinal and transverse veins close together and showing up well in dried material, margin red. *Scape* 60 mm long and 2 mm diameter, glabrous, green with slight red streaking; peduncular bract just visible above ground, white with red tip. *Raceme* compact, narrowly conical, up to 90 mm long, about 40 flowers. *Bracts* vestigial, slightly below the pedicel, white. *Pedicels* 4 mm long patent, reddish. *Perianth* rotate, faint sweet perfume, 10 mm across; segments subequal, spathulate, outer 4 mm long and 1,5 mm broad, inner 5 mm long and 2 mm wide, cream with pale green keel overlaid with brown streaking. *Stamens* erect, forming a ring round the ovary; filaments joined to the extreme base of the segments, oblong with apiculate tip supporting the anther, outer filaments 1,75 mm long and 1,25 mm wide, inner slightly longer and narrower, white. *Ovary* globose, 1,5 mm high and 1,5 mm across, green. *Style* cylindrical, 1 mm long, yellow.

Flowering time: February to April. Leafing period: April to October.

Distribution: *E. descendens* has a comparatively restricted distribution in the western Cape from the Van Rhynsdorp area north to the Richtersveld. It is found mainly on light sandy and granite soils in dry areas. (Fig. 13b).

E. descendens has close affinities with *E. zeyheri*, having very similar rotate flowers although the considerably shorter scape normally helps to separate them in the reproductive stage. The main distinguishing character of this

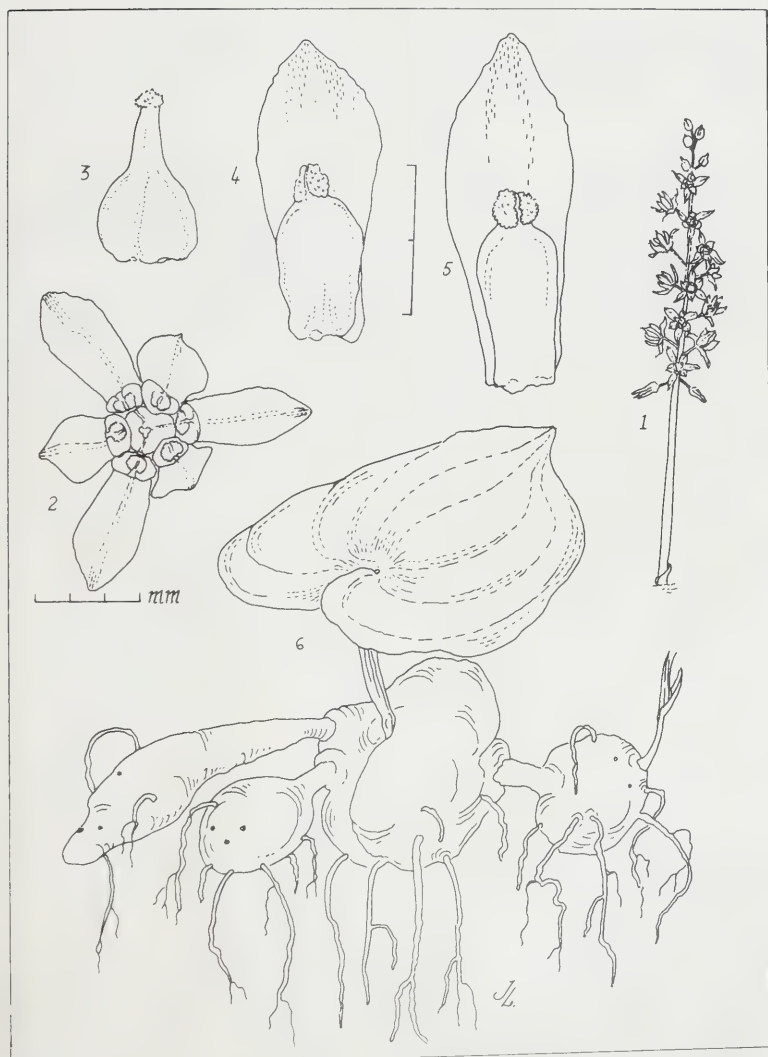


FIG. 11.

Eriospermum descendens. 1. Inflorescence, half natural size; 2. Flower face view; 3. Tuber and leaf; 4. Outer perianth segment and stamen; 5. Inner perianth segment and stamen; 6. Gynoecium. (van Jaarsveld 4390, NBG).

species is the tuber. The thick multi-directioned outgrowths form a massive irregular shaped tuber with several growing points, often resulting in a clump of closely packed overlapping leaves. This is unknown in any other species.

SPECIMENS EXAMINED

CAPE PROVINCE—2917 (Springbok): Steinkopf (-BC), *Marloth 13281* (PRE); Steinkopf, *Duthie 773, 2424* (STE); O'Kiep (-DB), *Marloth 11959* (PRE); Driekoppen, S of Springbok, *Perry 1545* (NBG); Near Driekoppies farm house, *van Berkel 153, 322* (NBG); Brakputz (-DC), *van Jaarsveld 5323* (NBG).

—3017 (Hondeklipbaai): Kamieskroon (-BB), *Marloth 13695* (STE).

—3118 (Van Rhynsdorp): Farm Kwaggaskop, Van Rhynsdorp (-BC), *van Jaarsveld 4390* (NBG); Old Sout Rivier Bridge, *Bruyns 1660* (NBG); Farm Atties, Van Rhynsdorp (-DA), *Perry 1021* (NBG).

Eriospermum bayeri P. L. Perry, sp. nov.; *E. zeyheri* affinis, sed folio erecto lanceolato, teretivagina folii extensa usque ad 30 mm supraterranea separatus.

Plantae hysternanthae. *Tuber* pyriforme, usque ad 60 mm altum, 20 mm latum; caro alba; crescens acumen basale. *Folium* erectum; vagina, quae eodem tempore est, usque ad 30 mm supraterranea, 1,5 mm diam, glabra; lamina lanceolata, usque ad 100 mm longa, 25 mm lata; superficies ambae glauco-virides, glabrae, leviter undulatae. *Scapus* usque ad 300 mm longus, 2,5 mm diam; bractea pedunculata usque ad 30 mm supraterranea, carnosa, puberula, apice retrorso. *Racemus* densus, usque ad 150 mm longus, 25 mm latus, usque ad 70 floribus. Bractee variabiles, usque ad 1,5 mm longae vel paene obsoletae, translucidae, membranaceae, carina viridi. *Pedicelli* 2–7 mm longi, patentes. *Perianthium* rotatum, circa 12 mm latum; segmenta post meridiem recurvascentia, aequalia usque ad subaequalia; spatulata, usque ad 5,5 mm longa, 3 mm lata, pallide viridia, carina viridi-rubra. *Stamina* erecta, conniventia, annulum facientia circa ovarium; fila oblonga, apiculata, 3 mm longa, 1,5 mm lata, alba; antherae luteae. *Ovarium* ovoideum circa 2 mm altum, 1,5 mm diam., clare viride. *Stylus* 1,25 mm longus.

Type: South Africa, Cape Province, Worcester, Karoo Botanic Garden, fl. 23/3/1977, *Perry 51* (NBG, holotype; K, PRE, isotypes). (Fig. 12).

Plants hysternanthous. *Tuber* solitary, pyriform, older tubers sometimes becoming irregular and knobbly with young tubers on the side, up to 60 mm high and 20 mm at the widest; outer skin pale brown, thin; inner flesh white; growing point basal with shoot passing upward in a lateral groove. *Leaf* solitary erect; old persistent sheaths up to 70 mm long, light to greyish-brown, membranous; contemporary leaf sheath exerted up to 30 mm, terete,

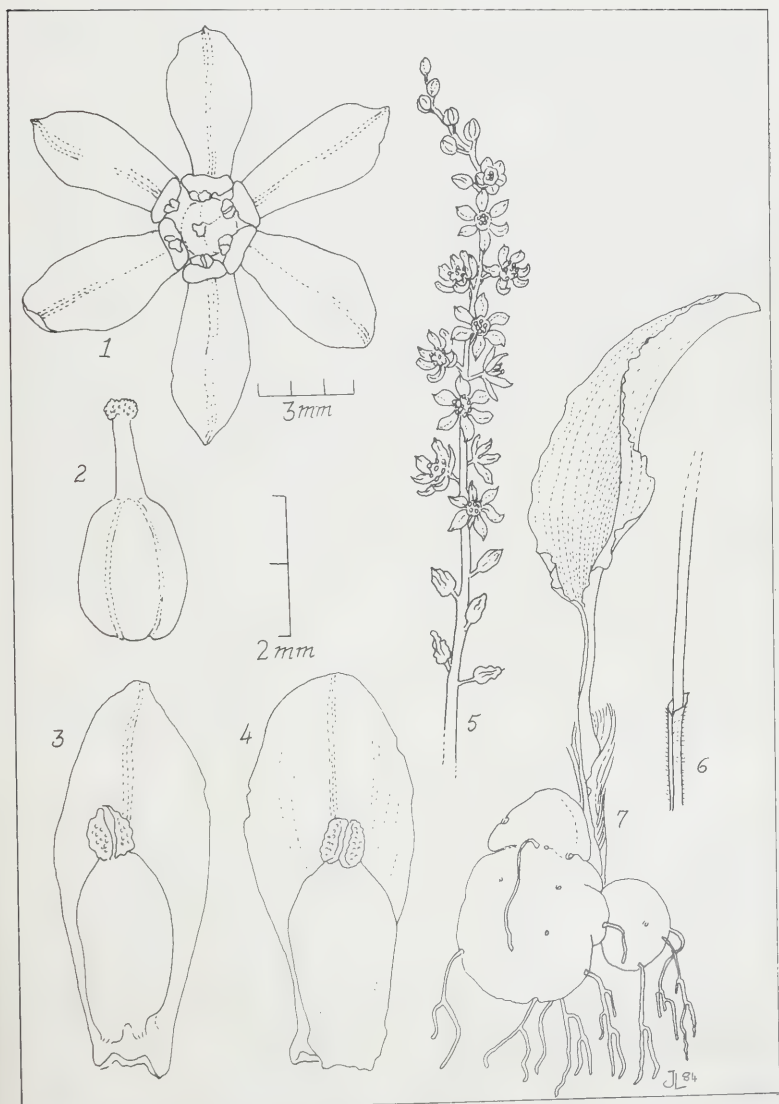


FIG. 12.

Eriospermum bayeri. 1. Flower, face view; 2. Gynoecium; 3. Outer perianth segment and stamen; 4. Inner perianth segment and stamen; 5. Inflorescence; 6. Peduncular bract and base of scape; 7. Tuber and leaf natural size. (Perry 51, NBG).

1.5 mm diameter, dark red just above ground level shading to glaucous green near the lamina, glabrous; lamina lanceolate when mature, up to 100 mm long and 25 mm wide, young leaves almost prostrate and ovate-cordate for the first 1–2 years, glaucous green both surfaces, glabrous, margin entire slightly undulate, base acuminate, apex acute. *Scape* up to 300 mm long and 2.5 mm diameter, glaucous green with tiny white dashes all over, above paler with red markings, glabrous; peduncular bract exerted up to 30 mm, green or purplish-red, fleshy, puberulous, apex retrorse. *Raceme* densely spicate, up to 150 mm long and 25 mm across with up to 70 flowers. *Bracts* variable, either slightly saccate-attenuate and up to 1.5 mm long or very small, almost obsolete and remote from the base of the pedicel, transparent-membranous with green keel. *Pedicels* 2–7 mm long, patent, pale green. *Perianth* rotate about 12 mm diameter; segments tending to be recurved in the afternoon, equal to subequal, spatulate, up to 5.5 mm long and 3 mm wide, pale green with a darker green keel and reddish streaks at the apex. *Stamens* erect connivent forming a ring round the ovary; filaments joined to the extreme base of the segments, lorate to spatulate, apiculate, 3 mm long and 1.5 mm wide, outer slightly narrower than inner, white; anthers yellow, introrse, versatile. *Ovary* ovoid about 2 mm high and 1.5 mm diameter, bright green. *Style* cylindrical, 1.25 mm long, white, stigma translucent, minutely papillose. *Capsule* surrounded by persistent perianth parts, carpels irregularly bi-lobed, apex depressed. Seeds covered with white silky hairs approximately 8 mm long.

Flowering time: March to May. Leafing period: April to October.

Distribution: *E. bayeri* is found in the Worcester–Robertson Karoo and in the Ceres or Tanqua Karoo north to the vicinity of Calvinia. It grows in dry, stony karroid areas on either flattish ground or on lower slopes of kopies of Malmesbury or Bokkeveld shales. (Fig. 13c).

This species has previously been confused with *E. lanceifolium* Jacq. because of the similarity in leaf shape. The leaf of *E. bayeri* however, has a uniform glaucous green colour, is always entirely glabrous and has a thinner texture than that of *E. lanceifolium*, which is more blue in colour, often becoming reddish on the lower part of the underside, also the leaf sheath and the underside of the leaf are often finely pilose. In pressed specimens *E. lanceifolium* leaves show a distinctive dark stippling not seen in leaves of *E. bayeri*. *E. lanceifolium* shows a preference for sandy soils, whereas *E. bayeri* is confined to clayey soils.

E. bayeri is most closely related to *E. zeyheri* and it is difficult to find any consistent points of difference between these two species in the flowering stage. The peduncular bract of *E. bayeri* is amplexicaul for a greater distance with the apex not opening out to become green and leaf-like as in *E.*

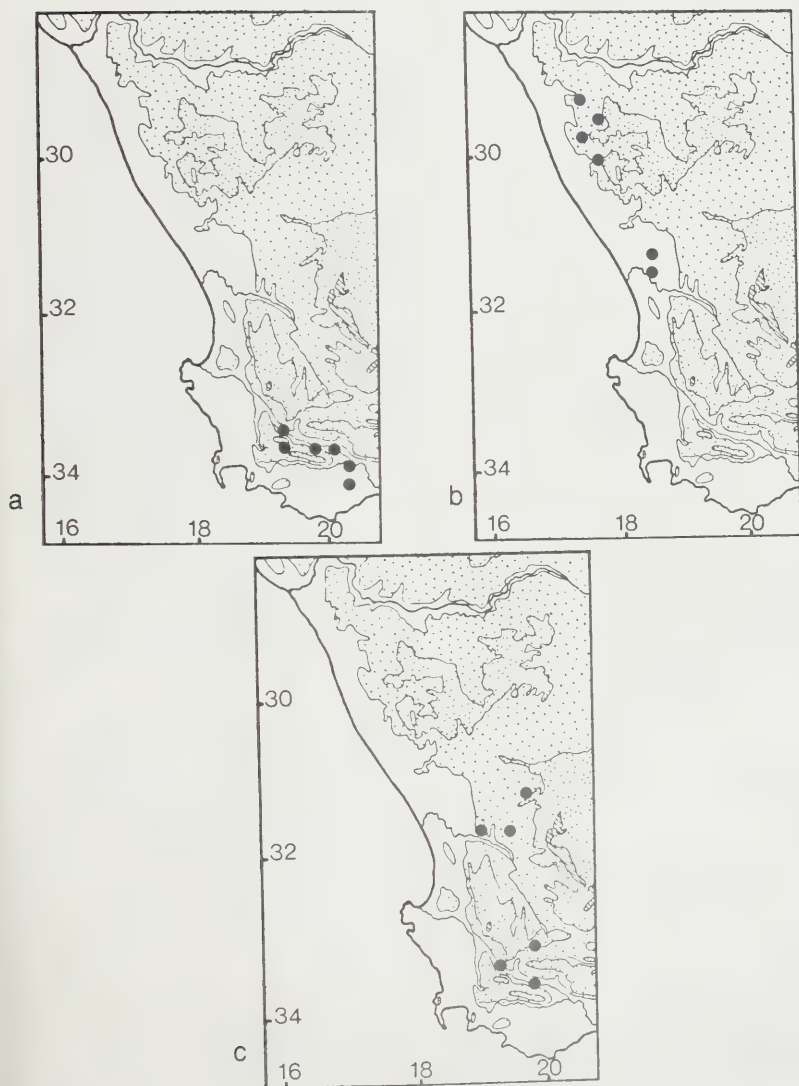


FIG. 13.

(a) Distribution of *Eriospermum breviscapum*; (b) Distribution of *Eriospermum descendens*; (c) Distribution of *Eriospermum bayeri*.

zeyheri. In leaf they are clearly distinct species. *E. bayeri* is confined to winter rainfall areas in the western Cape, whereas *E. zeyheri* tends to be in summer rainfall areas in the eastern Cape.

This species is named in honour of Mr. Bruce Bayer, curator of the Karoo Botanic Garden, who first introduced me to the genus *Eriospermum*, and in particular this species found in the veld reserve of the Karoo Botanic Garden.

SPECIMENS EXAMINED

CAPE PROVINCE—3119 (Calvinia): Akerendam (-BD), *Perry* 987 (NBG); 3 km south of Doringbos (-CC), *Perry* 1880 (NBG); Die Bos (-DC), *Perry* 889.

—3319 (Worcester): Hex River Pass (-BD), *Perry* 449 (NBG); Karoo Botanic Garden Reserve, Worcester (-CB), *Perry* 51 (NBG); Worcester West, *Perry* 1359 (NBG); Karoo Koppie, Robertson (-DD), *Duthie* 629a, 629b, 638, 639 (STE); 3 km east of Robertson, *Perry* 966 (NBG).

ACKNOWLEDGEMENTS

Too many colleagues and friends have helped in my efforts to collect material of *Eriospermum* to mention them all by name but my sincere gratitude is extended to all of them. Especial thanks are due to Mrs. Jeanette Loedolff, for her patient care with the illustrations and to Miss Deirdré Snijman for her invaluable guidance.

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THREE MORE NEW SPECIES OF *LACHENALIA* AND ONE NEW VARIETY OF AN EARLY SPECIES (LILIACEAE)

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ABSTRACT

Three new species of *Lachenalia* and one new variety of an early species are described, and the ripe seeds are used as diagnostic characters of the genus.

UITTREKSEL

'N VERDERE DRIE NUWE *LACHENALIA*-SPECIES EN EEN NUWE VARIETEIT VAN 'N VROEË SPECIES (LILIACEAE)

Drie nuwe *Lachenalia*-species en een nuwe varieteit van 'n vroeë species word beskryf, en die ryp sade word as 'n onderskeidende kenmerke vir die genus gebruik.

Key words: *Lachenalia*, sp. nov., Liliaceae, seed, diagnostic characters.

INTRODUCTION

Of the four species described *Lachenalia schelpei* is the most recent discovery, one bulb having been collected in the fruiting stage on the Hantam Mountains by Professor E. A. Schelpe in 1980; when it flowered in 1982 it proved to be unique.

The seed too is distinctive, being one of the largest in the genus, and the long ridged aril is slightly bulbous at the apex. The seeds of the three other plants belong to the group with inflated arils. *L. physocaulos* has a small seed with a short aril, in *L. arbuthnotiae* and *L. aloides* var. *vanzyliae* the seeds are slightly larger. In the former the aril is of medium length, while in the latter it is long.

Lachenalia schelpei W. Barker, sp. nov.; bulbo ovoideo bulbilis albis numerosis, ad basim faciculatum, distinguitur.

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FIG. 1.

Lachenalia schelpei; 1. Whole plant; 2. Young inflorescence; 3. Part of inflorescence; 4. Four flowers and bracts. (*Schelpe* s.n. sub NBG 127340).

Folia duo, lanceolata vel oblongo-lanceolata, maculis magnis viridibus, purpureo-vittatis basaliter. *Inflorescentia* subspicata multiflora. *Bracteae* angustae, lanceolatae, in statu gemmis prominenti. *Flores* parvi, oblongis-urceolati, patentes vel cernui, albi et virides. Segmenta interna superantia segmenta externa. Segmenta interna imbricata, ostium angustum formans. *Stamina* aequaliter dispositum circa ostium perianthii. *Semina* magnum, ovoideum, arillo longo porcato. *Arillus* bulbosus apicem versus.

Type Material: Cape Province—3119 (Calvinia): Hantamberg, Calvinia (-BC/-BD), 30/6/1982, E. A. Schelpe s.n. sub NBG 127340 (NBG, holotype; BOL, isotype).

Plant 225 mm high. *Bulb* ovoid, 25 mm diam., with a few dark brown membranous scales, and numerous white bulbils clustered round the base. *Leaves* two, lanceolate to oblong-lanceolate, light green, up to 180 mm long and 25–40 mm broad, acute, upper and lower surfaces with large flecks of green, merging into bands of maroon on the loosely clasping bases. *Peduncle* slender, up to 100 mm long, densely spotted with dark maroon. *Inflorescence* subspicate, many-flowered, up to 100 mm long and 30 mm diam.; flowers small oblong-urceolate, spreading to slightly cernuous, scented; pedicels very short, bracts long, narrow-lanceolate, membranous, whitish, very conspicuous in the bud stage. *Flowers* 10 mm long, 5 mm diam.; tube 2 mm long, white, narrowing at the base; outer segments 5 mm long white with greenish-brown gibbosities and pale green keels; inner segments 7 mm long, obovate, white with a green spot at the apex and a pale green keel shading to blue at the base, all overlapping to form a narrow mouth; stamens just exerted, the anthers arranged symmetrically round the rim of the mouth of the perianth; ovary ovoid, 5 mm long, 3 mm diam., pale green; style white up to 6 mm long, finally well exerted beyond the stamens. *Capsule* obovate, 5 mm diam.; seeds large ovoid with a long ridged aril which is slightly bulbous at the apex.

DIAGNOSTIC CHARACTERS

Although *Lachenalia schelpei* is only known from one collection, it is unique and worthy of specific rank. Its numerous small, white and green, oblong-urceolate flowers are almost sessile and subtended by narrow linear lanceolate bracts which are longer and particularly prominent in the bud stage. The stamens are arranged symmetrically and shortly exerted beyond the narrow mouth, the yellow anthers forming a ring. Its two lanceolate to oblong-lanceolate leaves are banded on the loosely clasping bases. The large seed has a long ridged aril which is slightly bulbous at the apex.

The reason why it has only been collected once may be due to the fact

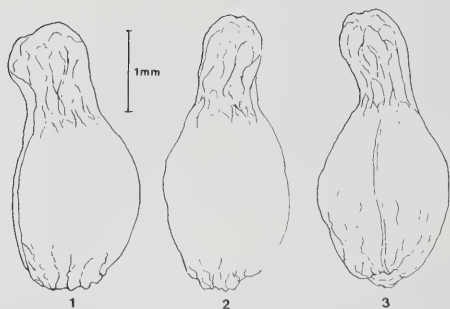


FIG. 2.

Lachenalia schelpei: 1. Seed side view; 2. Seed from above; 3. Seed from below. (*Schelpe* s.n. sub NBG 127340).

that it flowers in June to July. The type bulb was collected in seed in September 1980 by Professor E. A. Schelpe, in whose honour it is named. The bulb was grown in a pot and flowered on 30 June 1982. Several young bulbs flowered in cultivation in June 1983.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Calvinia): Hantamberg, Calvinia (-BC/-BD), 30/6/1982, E. A. Schelpe s.n. sub NBG 127340 (NBG, holotype; BOL, isotype).

Lachenalia physocaulos W. Barker, sp. nov.; pedunculo inflato marroni-no munite et dense maculato, folio singulari lineari-conduplicato, abrupte dilatato in basim membranaceum album amplectentem, distinguitur.

Flores parvi, multi, cernui vel patentes. *Tubus* caeruleus pallidus. *Segmenta* externa alba. *Segmenta* interna paucillum patentia, pallida purpurea, superantia segmenta externa. *Stamina* exserta. *Semina* parvula, globosa. *Arillus* inflatus, terminalia brevis.

Type Material: Cape Province—3319 (Worcester): Between Robertson and Macgregor (-DD), 13/9/1962, Lewis 5635 (NBG, holotype).

Plant 130–300 mm high. *Bulb* globose, 10–15 mm diam; outer tunics membranous, light brown. *Leaf* one very occasionally two; blade linear-conduplicate 180 mm long, 10 mm broad, glaucous-green, margin sometimes

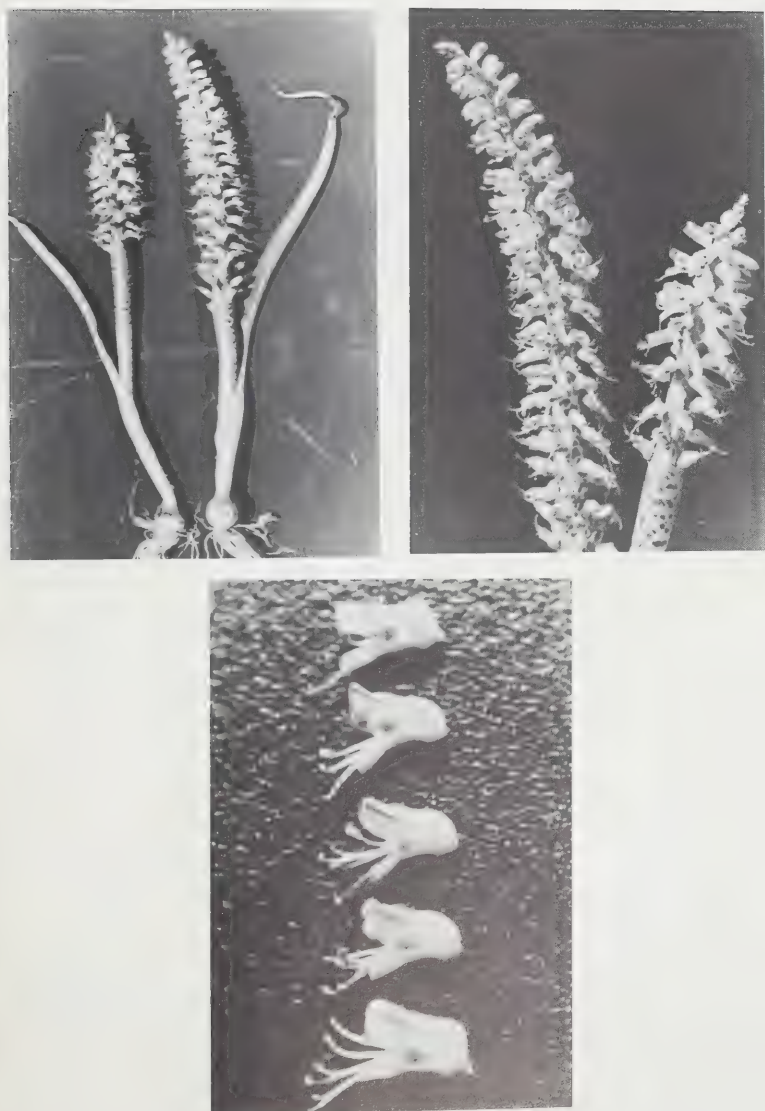


FIG. 3.

Lachenalia physocaulos: 1. Two plants; 2. Two inflorescences; 3. Five flowers.
(Wisura 452).

slightly undulate, base widening suddenly to form a white membranous clasping base. *Inflorescence* 60–150 mm long, 20–25 mm diam., subspicate; flowers many, dense, campanulate, spreading to cernuous; pedicels very short; rachis inflated toward the base, densely spotted with maroon; bracts very small, becoming narrow-lanceolate toward the apex. *Peduncle* inflated, broadest below the inflorescence, up to 180 mm long, 10 mm diam. at the widest part, densely spotted with maroon, shading to magenta at the base. *Flowers* campanulate, 9 mm long, rounded at the base; tube 2 mm long, very pale blue; outer segments ovate, up to 6 mm long, 4 mm wide, pale blue at the base, shading to white with greenish-brown gibbosities; inner segments slightly spreading, obovate, 8 mm long, 4,5 mm wide, shining pale magenta with brownish-green keels; stamens well exerted; filaments up to 13 mm long, pale magenta. *Ovary* ovoid, 2,5 mm diam; style exerted up to 9 mm long, pale magenta. *Capsule* ovoid, 5 mm diam., membranous; seed very small, globose, aril inflated, terminal, short.

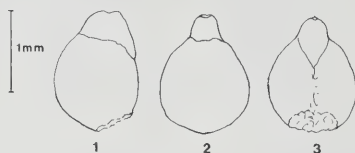


FIG. 4.

Lachenalia physocaulos: 1. Seed side view; 2. Seed from above; 3. Seed from below. (van Reenen s.n. sub NBG 108607).

DIAGNOSTIC CHARACTERS

Lachenalia physocaulos is characterised by its small, globose bulb, its usually single, glaucous, linear-conduplicate leaf which widens suddenly into a white membranous clasping base, its inflated, spotted peduncle and rachis, its many subspicate, campanulate, pale magenta flowers and its much exerted stamens. Its seed falls into the group with a short, terminal, inflated aril. It occurs in a sandy habitat.

The species has been given the specific name *physocaulos* on account of its inflated peduncle and rachis. It is not unique in this respect, as other species such as *L. mutabilis*, *L. violacea* and *L. ventricosa* also have inflated peduncles, but they differ in other respects. They all have seeds with inflated arils of varying lengths.

SPECIMENS EXAMINED

CAPE PROVINCE—3319 (Worcester): Between Robertson and Macgregor (-DD), 13/9/1962, *Lewis* 5635 (NBG, holo.); Erfdeel Farm, 2,2 m from Breede River

Bridge, on Robertson-Macgregor road, 24/8/1974, *van Reenen s.n.* sub NBG 108607 (NBG), 12/8/1974 (fruiting), *van Reenen s.n.* sub NBG 108607 (NBG); Erfdeel Farm 7 m S of Robertson on Road to Macgregor, 13/9/1969, *Wisura* 452 (NBG). —3420 (Bredasdorp): National Bontebok Park, Swellendam (-AB), Sept. 1962, *Liebenberg* 6467 (NBG, PRE).

Lachenalia arbuthnotiae W. Barker, sp. nov.; inflorescentia spicata densa floribus oblongis erectis-patulis laete flavis, distinguitur.

Folia uno vel duo, lanceolata, plerumque maculis magnis purpureis. *Flores* laete flava. Segmenta interna leviter longiora segmentis externis. *Stamina* aequantia segmenta interna. *Semen* arillum inflatum, longitudine media habet.

Type Material: Cape Province—3418 (Simonstown): Isoetes Vlei, Cape Flats, Wynberg (-BA), 19/9/1966, *M. Thomas s.n.* sub NBG 93529 (NBG, holotype).

Plant up to 400 mm high. *Bulb* globose, 15–20 mm diam.; outer tunics membranous, light brown. *Leaves* 1–2, lanceolate up to 120 mm long, 20 mm broad, light green, plain to heavily spotted above with dark purple; clasping base white, plain to lightly spotted, up to 60 mm long. *Peduncle* up to 140 mm long, minutely spotted with purple. *Inflorescence* spicate up to 200 mm long, 25–30 mm diam., many-flowered, dense, flowers erecto-patent; bracts white, membranous, narrow-lanceolate. *Flowers* 10–13 mm long, oblong, bright yellow; tube 3–4 mm long, yellow tinged with green; outer segments oblong, 5–8 mm long, yellow tinged with green, gibbosities pale green; inner segments 2–3 mm longer than outer, obovate-oblong overlapping and scarcely patent, 7–10 mm long, bright yellow, paler at the margins; stamens as long as inner segments; ovary ovoid 4 mm long, pale green; style white as long as stamens. *Capsule* membranous, oblong, 10 mm long; seeds globose with inflated aril of medium length.

DIAGNOSTIC CHARACTERS

Lachenalia arbuthnotiae is characterised by its dense spicate inflorescence of bright yellow, erecto-patent, oblong flowers with the inner segments a little longer than the outer, overlapping and scarcely patent, and the stamens as long as the inner segments. The one or two lanceolate leaves are usually spotted above with purple, densely so, in the plants in the type locality. The seed has an inflated aril of medium length.

Lachenalia arbuthnotiae is intermediate between *L. orchoides* (L.) Ait. and *L. fistulosa* Bak. The three species all have seeds with inflated arils of various lengths. *L. orchoides* has larger more tubular flowers with the inner segments longer in proportion to the outer and more patent, and the inflor-

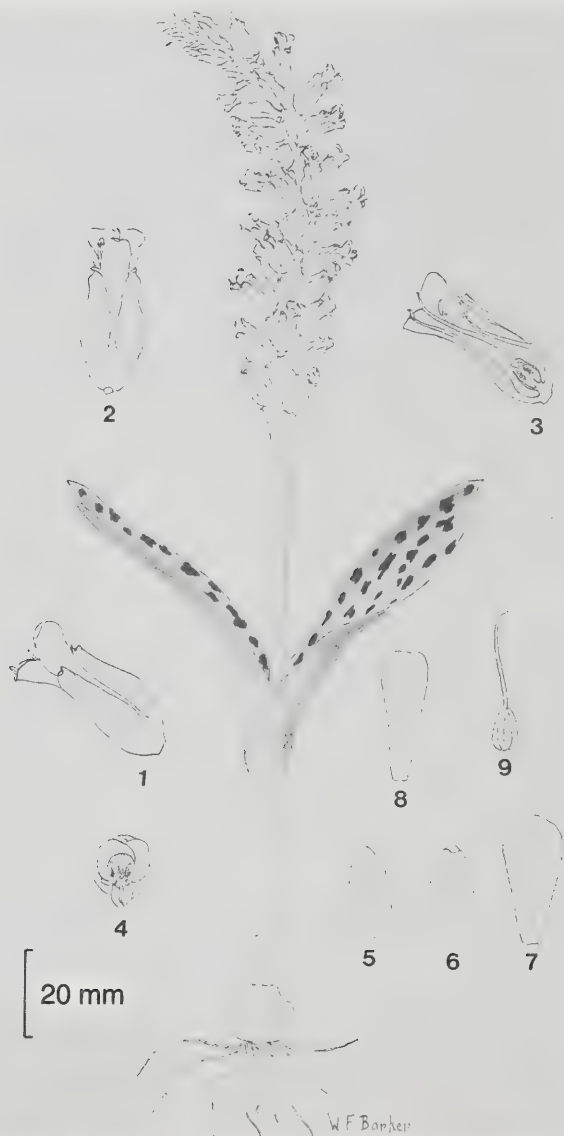


FIG. 5.

Lachenalia arbuthnotiae: 1. Flower side view; 2. Flower from below; 3. Longitudinal section of flower; 4. Flower front view; 5. Lower outer perianth segment; 6. Upper outer perianth segment; 7. Upper inner perianth segment; 8. Lower inner perianth segment; 9. Gynoecium, all $\times 3$. (*Arbuthnot* s.n. sub BOL 21954).

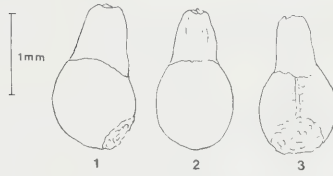


FIG. 6.

Lachenalia arbuthnotiae: 1. Seed side view; 2. Seed from above; 3. Seed from below. (Thomas s.n. sub NBG 93529).

escence is usually fewer-flowered and more lax. It has a very wide distribution and occurs in many types of habitat. *L. fistulosa* is daintier than either of the others, the flowers are smaller and the inner segments recurved and often undulate. It appears to be confined to rocky mountain slopes, while *L. arbuthnotiae* is found on the low lying areas of the Cape Flats.

The species is named in honour of Miss I. Arbuthnot who collected it first in 1931 and who for many years was technical assistant at the Bolus Herbarium, and after she retired mounted many thousands of specimens at the Compton Herbarium.

SPECIMENS EXAMINED

CAPE PROVINCE—3318 (Cape Town): Blaauwberg Road (-CD), 28/8/1931, *I. Arbuthnot* s.n. sub BOL 26457 (BOL); Cape Flats near Klipfontein (-DC), 29/9/1934, *Salter* 4868 (BOL).
—3418 (Simonstown): Plumstead Flats (-AB), Sept. 1931, *Arbuthnot* s.n. sub BOL 20455 (BOL); Isoetes Vlei, Cape Flats Flora Reserve (-BA), 19/9/1966, *Thomas* s.n. sub NBG 93529 (NBG, holo., iso.), 17/11/1966 (fruiting) *Thomas* s.n. sub NBG 93530 (NBG), 2/10/1960 (fruiting) *Stephens* s.n. sub NBG 93444 (NBG); Faure, Cape Flats (-BA/-BB), 10/8/1934, *I. Arbuthnot* s.n. sub BOL 21954 (BOL), 20/9/1938, *Bolus* s.n. sub NBG hort. 936/32 (NBG); Cape Flats near Fireworks Factory on road to Swartklip, 15/10/1967 (fruiting), *Rourke* 953, 7/9/1972, hort. Compton Herbarium, *Rourke* 953 (NBG).

***Lachenalia aloides* (L.f.) Hort, ex Aschers. & Graebn. var. *vanzyliae* W. Barker, var. nov.**; differt a aliis varietatibus coloratibus, floribus pallidibus et subtilibus tinctis. Flos tubum pallidum sub viridem habet; segmentum externum album carinis subviridibus, segmentum internum pallidum chlorinum marginibus albis.

Folia uno vel duo, lanceolata, ovata vel lorata. *Inflorescentia* racemosa. *Flores* penduli, tubiformes, segmenta interna superantia segmenta externa. *Stamina* segmenta interna aequantia. *Semina* arillo longo inflato terminali.



FIG. 7.

Lachenalia aloides var. *vanzyliae*; 1. Flower side view; 2. Flower from below; 3. Longitudinal section of flower $\times 2$; 4. Upper outer perianth segment; 5. Upper inner perianth segment; 6. Gynoecium. (van Zyl NBG hort. 2802/1927).

Type Material: Cape Province—3218 (Clanwilliam): Top of Piketberg Mt. above town, cultivated at Compton Herbarium (-DC), 14/9/1966, W. Barker 10349 (NBG, holotype).

Plant up to 260 mm, usually less. *Bulb* ovoid, 10–20 mm diam; outer tunics membranous, light brown. *Leaves* two or one, blade 28–250 mm long, 10–50 mm broad, lanceolate, ovate-lanceolate or lorate, light green, usually spotted above with light purple, occasionally almost pustulate; loosely clasping base, plain or lightly spotted. *Peduncle* slender, spotted with maroon. *Inflorescence* racemose, up to 120 mm long, 40–50 mm diam., few to many-flowered, lax; pedicels 3–7 mm long; flowers pendulous; bracts membranous, white, narrow-lanceolate, usually some aborted flowers at the apex. *Flowers* tubular, 15–20 mm long; tube pale viridian, 3–4 mm long, usually narrowed toward the base, very occasionally rounded; outer segments oblong, 12–15 mm long, white with viridian keels and yellow-green gibbosities; inner segments obovate-oblong, emarginate, pale yellow-green with white margins, 10–18 mm long; stamens white, as long as inner segments; ovary obovoid, pale green; style white, as long as stamens. *Capsule* obovoid, membranous. *Seed* globose with a long terminal inflated aril.

DIAGNOSTIC CHARACTERS

Var. *vanzyliae* differs from all the other colour varieties of *L. aloides* in having pale delicately shaded flowers, pale viridian at the base, the outer segments white with viridian keels and pale yellow-green gibbosities, the inner segments longer than the outer pale yellow-green, shading to white at the margins.

This attractive variety of *L. aloides* is known to occur on the Piketberg, Porterville, Elands Kloof, Cedarberg and Twenty Four Rivers mountain ranges. It is named in honour of Mrs van Zyl who first introduced it into Kirstenbosch in 1927, where it flowered in 1929 and was illustrated and

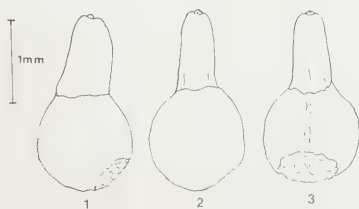


FIG. 8.

Lachenalia aloides var. *vanzyliae*: 1. Seed side view; 2. Seed from above. 3. Seed from below. (Barker 10349).

given its manuscript name. At the time it was thought to be sufficiently distinct to be given specific rank, but as *L. aloides* has been found in so many colour varieties and the seed of this plant conforms to the species pattern, it seems best to accommodate it as a variety.

Evidently it was known to Linnaeus filius for in his *Supplementum Plantarum* p. 205 (1781), under the name *Phormium aloides* he describes the flowers as—"Floribus nutantibus cylindrico-infundibuliformis. Variat corollis luteis, corollis croceis, corollis sanguineis apice purpureis, corollis albivirescentibus, et variat proportionem inter petala exteriora et interiora. Species difficile determinatur".

On the Piketberg range, var. *vanzyliae* grows on the same rocky areas as another variety, which has much longer yellow flowers tinged with green on the keels and tips of the inner segments, while the buds are red. Only one plant has been found which is obviously a cross between the two varieties, as the flowers are intermediate in length, pale yellow in colour and are tinged with viridian at the base.

L. aloides as a complex species, including its varieties, is widely distributed, from sea level to high altitudes. It has been recorded from rocks close to the sea at Cape Point, and northwards as far as Lamberts Bay and eastwards to Skipskop in the Bredasdorp division. It extends inland on rocky outcrops and the mountain ranges, from Bains Kloof to the Piketberg and Cedarberg in the north. Some of the varieties are endemic to very restricted areas. It is the most varied and colourful species in the genus, and probably the best known and widely cultivated, and has frequently been used for hybridisation.

SPECIMENS EXAMINED

CAPE PROVINCE—3218 (Clanwilliam): Piquetberg Mt. (-DC), Sept. 1929, Mrs van Zyl s.n. hort. NBG 2802/1929 (BOL); Kapteins Kloof, Piquetberg, 11/9/1935, Pillans 7673 (BOL); Koggelmanderskop, Piquetberg Mt., 28/9/1953, Dr. Brink s.n. sub NBG 82128 (NBG); Piquetberg Mt., 10/9/1953, Mrs Brink s.n. sub NBG 72204; Top of Versveld Pass, Piquetberg, 10/10/1955, de Wet s.n. sub PRE 00917 (PRE); Piquetberg Mt. top, 9/9/1963, Thomas s.n. sub NBG 93629 (NBG); Piquetberg Mt. top, 14/9/1965, Oliver s.n. sub NBG 94934 (NBG); Piquetberg Mt. top above town, 14/9/1966, W. Barker 10349 (NBG, holo.); Piquetberg Mt. top, 6/10/1971, Thomas s.n. sub NBG 93040 (NBG).

—3219 (Wupperthal): Crystal Pool, Cedarberg (-AC), 22/9/1930, Barnes s.n. sub BOL 21936 (BOL); Elands Kloof, Citrusdal to Ceres road (-CA), 30/9/1944, W. Barker 3060 (NBG); Elands Kloof Mts., 7/10/1936, Malan s.n. (BOL); Elands Kloof, 26/9/1936, Lewis s.n. sub BOL 22100 (BOL); Olifants River near Warmbaths, 22/9/1911, Stephens, Percy Sladen Mem. Exp. 7742 (K); Porterville Mts. (-CC), 8/10/1976, D. Rust s.n. (STE); Porterville Mts., S end of Teefontein Farm, 10/10/1966, M. Thompson 234 (STE).

—3319 (Worcester): Twenty Four Rivers Mts. (-AA), 18/10/1954, Esterhuysen 23773 (BOL).

Inexact locality: C.B.S. Sparman s.n., Herb. Castromii (S).

ACKNOWLEDGEMENTS

I am much indebted to Dr. J. P. Rourke for the Latin translations of the diagnoses, and to Miss C. Malan for the Afrikaans translation of the abstract.

A REVISION OF *TROMOTRICHE* HAW. (ASCLEPIADACEAE)

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ABSTRACT

The recently resurrected small genus *Tromotriche* Haw. is revised. The three species are discussed and described in detail; an artificial key to the species is provided as well as a map showing their distribution.

UITSREKSEL

'N HERSIENING VAN *TROMOTRICHE* HAW. (ASCLEPIADECEAE)

Die onlangs-herstelde klein genus *Tromotriche* Haw. word hersien. Die drie species word in detail bespreek en beskryf; 'n kunsmatige sleutel tot dié species word voorsien asook 'n kaart om die verspreiding te toon.

Key words: *Tromotriche*, *Stapeliaeae*, *Asclepiadaceae*.

Tromotriche Haw., Syn. Pl. Succ.: 36 (1812), p.p. excl. *T. pruinosa*; Suppl. Pl. Succ.: 10 (1819).—Sweet, Hort. Brit. ed. 2: 358 (1830), p.p. excl. *T. ciliata*, *T. mutabilis*, *T. obliqua*, et *T. pruinosa*.—G. Don, Gen. Syst. 4: 119 (1838), p.p. excl. *T. obliqua* et *T. pruinosa*.—Leach in Jl S. Afr. Bot. 48(3): 425 (1982). Lectotype species: *Tromotriche revoluta* (Masson) Haw.

Stapelia auct. pl., p.p. min. et ut in sectio *Tromotriche* vel illi comparandae, Schultes in Roem. & Schult., Syst. Veg. 6: 34 (1820), ut *Tromotrichae*.—Endlicher & Fenzl, Gen. Pl. 1: 598 (1838), ut in sectio "e".—Decaisne in DC, Prodr. 8: 657 (1844), ut Sect. V, p.p. excl. *Stapelia obliqua* & *S. pruinosa*.—Bentham & Hooker, Gen. Pl. 2,2: 785 (1876), ut sect. IV.—Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4(2): 280 (1897), ut Sect. IV.—Post & Kuntze, Lex. Gen. Phan.: 532 (1904), ut *Tromatriche*.—Berg-er, Stap. u. Klein.: 181 (1910), ut *Tromatriche*, et in: 225 excl. *Stapelia bella* & *S. incomparabilis*.—White & Sloane, Stapeliaeae, ed. 2,2: 419 (1937), ut Sect. IX, et in: 428 (1937), excl. *S. bella*, *S. comparabilis* & *S. incomparabilis*.—Jacobsen, Lexicon Succ. Pl.: 374 (1974), ut Sect. IX, excl. *S. bella*, *S. comparabilis*, *S. incomparabilis* et *S. prognatha* ("prognantha").

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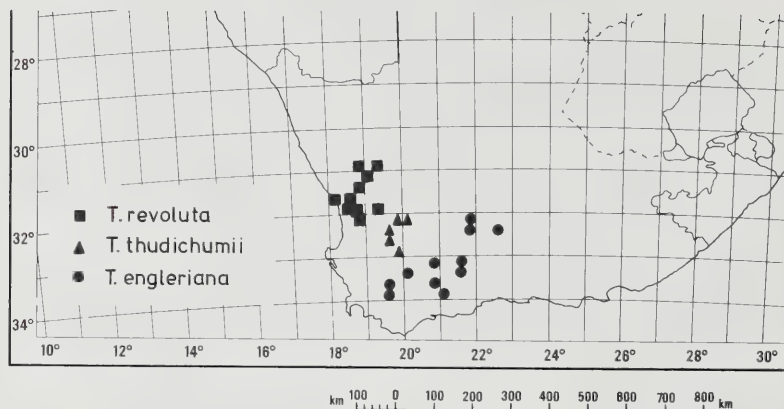


FIG. 1.
Tromotriche Haw. Map showing distribution of the species.

This small genus comprising only three species with practically contiguous, discrete distributions appears to be phyletically related to *Stapelia* L., *Tridentea* Haw. and *Orbea* Haw., as well as having strong links with *Caralluma* R.Br. (*Quaqua* N. E.Br.), being closest, as a group, probably to *Tridentea*. However, the three species appear to be more closely related to each other than to any one of the above genera; fortunately they exhibit diagnostic characters and correlations which confirm this and are adequate for recognition of the group at generic level. That it forms part of the reticulate phylogeny of these south western taxa seems obvious both morphologically and geographically; in this connection attention should perhaps be drawn to *Tridentea peculiaris* (Luckhoff) Leach, which is, to a slight extent, anomalous in that genus, has a rhizomatose habit and, like *Tromotriche thudichumii* (Pillans) Leach, a dual chromosome number.

The overall facies of the generally few-stemmed very sparingly randomly (not sympodially) branched rhizomatose plants with an inflorescence of sessile or subsessile fascicles of shortly pedicellate, strongly revolute flowers, produced randomly along the sides of the stems is quite distinctive. The stems and branches, apart from the variation in pubescence, are quite homogeneous in form, and all have a tendency to develop jointed segments. They are, in general, closer to those of *Tridentea* than of *Stapelia* except for the intermittent presence of stipular "glands" in two species, which are indicative of the stapelia connection. The flowers are also somewhat "Triden-

tea" in character but the reflexed corolla and the thickening around the mouth of the shallow tube, combine to impart the almost unique character which is most apparent in those of *T. revoluta*.

Plants few-stemmed, erect or sometimes partly trailing, to some extent rhizomatose, sometimes extensively so, especially in *T. revoluta*, stems rooting where touching the ground. *Stems* 4-angled, pubescent or glabrous, not or very sparingly and not sympodially branched, almost parallel-sided, often jointed or segmented, tubercle teeth small, horizontally spreading, often developing a hard brown callus similar to that frequently forming on the stems of *Caralluma* (*Quaqua*) species; leafless or virtually so. *Inflorescence* randomly disposed in small fascicles along the sides of the stems; peduncle obsolescent, cuspidate; pedicels generally short, flowers facing outwards. *Corolla* strongly revolute, often with the lobe apices reaching the pedicel below the calyx, lobed to 50–60%; lobes broadly ovate-acuminate or deltate, inside smooth or transversely rugulose, variably micro-papillate and/or micro-asperulous, often very sparsely and patchily so; tube usually markedly pentagonal inside, in one species sometimes more or less circular at the mouth, with the corolla much thickened around the mouth and sometimes partially closing the tube, and the thickening extending into the walls of the tube. *Corona* variably sessile to stipitate; outer lobes micro-papillate; inner lobes two-horned, the outer horn linear, much compressed and flattened.

Cytologically odd with one species diploid (tetraploid), one tetraploid and the other hexaploid.

Patristic convergence is so prevalent throughout the tribe *Stapelieae* and most characters are so variable that positive key characters are almost non-existent, and one has to rely to a large extent on facies or combinations of characters for the identification of taxa, particularly at genus level.

The small genus *Tromotriche* Haw. is an example of this kind of position and the following table has been prepared to illustrate that although somewhat heterogeneous it comprises species which are more closely related to each other than any one is to its otherwise nearest relative.

The characters used in the table are those which are present in at least two of the species of *Tromotriche* and to which corresponding characters occur among the related taxa with which comparisons are made, but excluding those which are more or less universal in the related groups.

Presence 'X' or absence 'O' is not entirely positive in every instance and where there is significant variability or a decided tendency in the taxon concerned (e.g. as in *T. pedunculata* towards a monopodial habit), a combination of the two symbols has been used.

TABLE 1.
Comparison of *Tromotriche* characters with those of related taxa.

	<i>Tridentea gemmaiflora</i>	<i>Tridentea pedunculata</i>	<i>Tridentea peculiaris</i>	<i>Tromotriche engleriana</i>	<i>Tromotriche revoluta</i>	<i>Tromotriche thudichumii</i>	<i>Stapelia flavopurpurea</i>	<i>Stapelia erectiflora</i>	<i>Stapelia</i> spp. Sect. <i>Stapelia</i>	<i>Orbea</i> spp.
Monopodial habit randomly few branched	O	✗	O	X	X	X	✗	O	O	O
Plants rhizomatous	O	O	X	X	X	X	✗	O	O	✗
Tubercle teeth spreading	X	X	X	X	X	X	O	O	O	X
Leafless or virtually so	O	X	O	X	X	X	O	O	O	X
Inflorescence random	X	X	X	X	X	X	O	O		
Corolla strongly revolute	O	O	O	X	X	X	O	X	O	O
Corolla glabrous but micro-sphaerico-papillate	O	X	X	X	X	X	O	O	O	
Tube diameter large	O	O	✗	X	X	X	O	O	O	✗
Tube markedly pentagonal at mouth	O	O	O	X	✗	X	O	O	O	✗
Peduncle obsolescent	O	✗	O	✗	X	X	O	✗	O	O
Stems glabrous or virtually so	X	X	X	O	X	X	O	O	O	X
Stipules glanduliform	O	O	O	X	O	X	X	X	O	
Pedicel-calyx glabrous or virtually so	X	X	X	O	X	X	O	O	O	X
Cilia clavate vibratile	X	X	X	O	X	X	O	O	O	✗
Pollinia large	O	O	O	X	X	O	O	O	X	✗
	<i>Tridentea</i>			<i>Tromotriche</i>			<i>Stapelia</i>			<i>Orbea</i>
O	10	6	7	3	1	1	11	11	13	7
✗	—	2	1	1	1	—	2	1	—	5
X	5	7	7	11	13	14	2	3	2	3

A KEY TO THE SPECIES OF *TROMOTRICHE*

- 1 Stems glabrous or virtually so; corolla smooth, with vibratile clavate cilia
 - 2 Corona partly or almost wholly included in the tube, outer lobes subquadrate, obtusely dentate, erectly spreading, inner lobes clavate, erectly recurved; stems usually \pm acute angled 1. *revoluta*
 - 2 Corona exerted from the shallow tube, outer lobes oblong, bifid, horizontally spreading, inner lobes scarcely or not at all clavate, incumbent on the anthers but not or scarcely produced above them; stems usually \pm obtuse angled 2. *thudichumii*
- 1 Stems pubescent, corolla transversely rugulose, almost or quite eciliate 3. *engleriana*

1. *Tromotriche revoluta* (Masson) Haw., Syn. Pl. Succ.: 36 (1812), et Suppl. Pl. Succ.: 11 (1819).—G. Don, Gen. Syst. 4: 119 (1838).—Leach in JI S. Afr. Bot. 48: 425 (1982). Lectotype: *Masson*, Stap. nov.: t. 10

Stapelia revoluta Masson, Stap. Nov.: 12, t. 10 (1796).—Willd. Sp. Pl. 1: 1277 (1797).—Sims in Bot. Mag. 19: t. 724 (1804).—Aiton, Hort. Kew. ed. 2, 2: 85 (1811).—Jacq. Stap.: t. 45 (1806–1819).—Schultes in Roem. & Schult., Syst. Veg. 6: 34 (1820).—Decaisne in DC., Prodr. 8: 657 (1844).—Schumann in Engl. & Prantl. Pflanzenfam. 4: 2 (1897).—Schlechter in J. Bot. 36: 483 (1898).—N. E. Br. in Gard. Chron. 1904, 36: 206 (1904), et in Thiselton-Dyer, Flora Cap. 4(1): 980 (1909).—Berger, Stap. u. Klein.: 226 (1910).—White & Sloane, Stapelieae, ed. 2, 2: 654 (1937).—Phillips in Flower. Pl. S. Afr. 18: t. 704 (1938).—Jacobsen, Lexicon Succ. Pl.: 381 (1974). Type: as above.

Stapelia glauca Jacq. Stap.: t. 44 (1806–1819), (1809 or earlier, fide White & Sloane, op. cit. 1: 94 (1937).—Willd., Enum. Pl. Hort. Berol.: 279 (1813).—Hornem., Hort. Hafn. 1: 247 (1813).—Schultes in Roem. & Schult., Syst. Veg. 6: 34 (1820).—Spreng., Syst. Veg. 1: 840 (1825), p.p. excl. syn.—Decaisne in DC., Prodr. 8: 657 (1844). Lectotype: Jacq. Stap.: t. 44.

Stapelia fuscata Jacq. Stap.: t. 46 (1806–1819).—Decaisne in DC., Prodr. 8: 657 (1844).—Schlechter in J. Bot. 36: 480 (1898). Lectotype: Jacq. Stap. t. 46.

Tromotriche glauca Hort. Donn ex Haw., Syn. Pl. Succ.: 37 (1812) Basionym: *Stapelia glauca* Donn, Hort. Cantab. ed. 6: 66 (1811), nom. nud. Type: dried flowers only (not seen).

Tromotriche glauca β . Haw., Syn. Pl. Succ.: 37 (1812).—*Tromotriche glauca* Haw., Suppl. Pl. Succ.: 11 (1819).—G. Don, Gen. Syst. 4: 119 (1838). Type: as for *Stapelia glauca*.

Tromotriche fuscata (Jacq.) Haw., Suppl. Pl. Succ.: 10 (1819). Type: as for *Stapelia fuscata*.

Stapelia protensa Hornemann, Hort. Hafn. Suppl.: 30 (1819). Type: not traced.

Stapelia tigridia Decaisne in DC., Prodr. 8: 657 (1844). Lectotype: Icon. Sims in Bot. Mag. 19: t. 724.

Stapelia revoluta var. *tigridia* (Decaisne) N. E. Br. in Thiselton-Dyer, Flora Cap. 4(1): 981 (1909).—White & Sloane, Stapelieae, ed. 2, 2: 656 (1937).—Jacobsen, Lexicon Succ. Pl.: 381 (1974). Type: as for *Stapelia tigridia*.

Stapelia revoluta var. *fuscata* (Jacq.) N. E. Br. in Thiselton-Dyer, Flora Cap. 4(1): 981 (1909).—Berger, Stap. u. Klein.: 228 (1910).—White & Sloane, tom. cit.: 657 (1937).—Jacobsen, Lexicon Succ. Pl.: 381 (1974). Type: As for *Stapelia fuscata*.

Stapelia revoluta var. *glauescens* Rüst ex Berger, Stap. u. Klein.: 228 (1910).—White & Sloane, tom. cit.: 656 (1937). Type: not traced.

Plants rhizomatose, few-stemmed, sometimes forming large patches of scattered single stems or sometimes stems more or less clumped. *Stems* glabrous, 4-angled, more or less parallel-sided, sometimes slightly segmented, angles lightly sinuate-dentate, teeth small, horizontally spreading; leafless, estipulate or rarely when young with somewhat leaf-like "denticles" similar to those sometimes seen in some orbeas, the teeth often obscured by a leathery, brown, spreading callus. *Peduncle* obsolescent, cuspidate. *Pedicel* glabrous, rarely micro-asperulous, up to 15 mm long. *Sepals* glabrous, up to 8 mm long. *Corolla* very variable in size, exceptionally up to 68 mm diam. when flattened, lobed to $\pm 55\%$, strongly revolute; outside glabrous; inside smooth, glabrous but to some extent micro-sphaerico-papillate and micro-asperulous, yellow to red-brown, paler in the centre (drying to dark red-brown); lobes broadly ovate, acute or shortly acuminate, ciliate with long purple vibratile clavate cilia; tube wide, markedly pentagonal inside, sometimes more or less circular at the much thickened mouth, often pubescent at the base inside. *Corona* very variable and variably raised on a pentagonal pedestal, sometimes subsessile, consequently variably partially included (rarely almost wholly); outer lobes brown, more or less subquadrate or sometimes subcircular, obtusely bifid or usually tridentate, sometimes subtruncate; inner lobes yellow, purple-speckled, 2-horned, the inner incumbent on the anthers, erectly connivent or convergent, recurved above, filiform, tuberculate-clavate; the outer narrowly triangular obtuse, laterally compressed, spreading, up to 4 mm long but often reduced to little more than a gibbosity. *Pollinia* more or less "D"-shaped, $0,8 \times 0,5$ mm. *Follicles* not seen.

Distributed in the Vanrhynsdorp, Calvinia and Clanwilliam districts, *T. revoluta* occupies a wide variety of habitats and soils and it seems worthwhile to quote from a letter from Harry Hall, latterly of Kirstenbosch,



FIG. 2.
Tromotriche revoluta in cultivation at PRE. Photo by courtesy of the Director,
Botanical Research Institute, Pretoria.

"always 50% of its bulk is underground" . . . "on Liebendal (near Vredendal) in deep red sand in full sun, stems only 5–10 cm emerged here and there quite far from where the underground portions commence" . . . "in the white quartz field over clay at Hol River, stems emerged only half a thumb's length above ground, scattered over an area 2 m or more in diameter—rhizomes 60 cm or more long are common at this locality" . . . "plants growing in these conditions seldom looked happy and I have never seen them in flower or fruit" . . . "plants in dense scrub in the Olifants River Valley, in Botterkloof and near the Giftberg summit are naturally taller and stouter".

Flowers vary from pale yellow green with purple lobes, yellow-brown to brown (all drying to a reddish-brown colour). As suggested by White & Sloane, tom. cit.:655, it seems probable that the several varieties which have been described should be considered as being hybrids of cultivation as they do not appear to occur in the wild.

MATERIAL EXAMINED

SOUTH AFRICA, CAPE—3018 (Kamiesberg): Grootklip, SW of the Langberg (-DD), 28/11/1956, *Acocks 19054* (PRE).

—3019 (Loriesfontein): Loeriesfontein (-CD), cult. NBG, fl. 3/1929, *Ross-Frames* in NBG 1285/26 (BOL).

—3118 (Vanrhynsdorp): Grootdrift (-BD), cult. Umtali 1972, *Plowes 3670* (PRE); Papendorp (-CA), rocks above salt pan, 27/5/1977, *Bruyns 1447* (NBG); 5 mls SE of Vredendal, Farm Richtan (-DA), 10/1967, *Haagner* in PRE 30386 (PRE), idem cult. Umtali, 13/3/1970, sub *Plowes 3028* (PRE); 4 mls W of Vanrhynsdorp (-DA), 4/4/1963, *Stayner 1959* (NBG); Klaver (-DC), cult. Claremont, 4/1945, *Leipoldt 4147* (BOL); 2 mls N of Bulshoek Barrage (-DD), 17/6/1976, *Bruyns 1073* (NBG).

—3119 (Calvinia): 6 mls N of Grasberg (-AA), 25/6/1975, *Bruyns 1099* (NBG); 9 mls N of Grasberg (-AA), cult. KGW, *Wisura* in KGW 287/74 (NBG); Wolwe Graafwater, S of Langeberg (-CD), cult. PRE, 2/9/1956, *Acocks 18955* (PRE); Botterkloof Pass (-CD), cult. NBG, 19/1/1959, *Hall 1397* (NBG); "Botterkloof" 9/5/1953, *Hall 699* (NBG).

—3218 (Clanwilliam): Kleinkliphuis (-BB), cult. PRE, 3/1966, *Hardy 1738* (PRE), ibid. cult. Umtali, sub *Plowes 5355*, 1980, *Rostrance* (PRE); 1 ml SE of Clanwilliam (-BB), cult. Cape Town, 4/1911, *Pillans 158* in *H. Bolus* (BOL).

Locality imprecise or lacking: Hort. Bolus, 1931, *H. H. Bolus 237* (BOL); Olifants Riv., 5/1936, *Smithers* in SAM 52231 (SAM); Doornbosch, Clanwilliam 17/3/1948, *Leipoldt* in NBG 511/46 (NBG).

2. *Tromotriche thudichumii* (Pillans) Leach, in JI S. Afr. Bot. 48: 425 (1982).

Stapelia thudichumii Pillans in JI S. Afr. Bot. 25: 375 (1959).—Jacobsen, Lexicon Succ. Pl.: 382 (1974). Type: Cape, Uitkomst, Tanqua Karoo, *Thudichum* in Herb. Bolus 26740 (BOL!).

Chromosome number $2n = 22$ (44) F. Albers, in litt., 1980 K652 (KIEL).

Plants generally comprising scattered, simple or few-branched stems, connected by fleshy rhizomes, erect or partially trailing, usually growing in and supported by small twiggy shrublets. Stems 4-angled up to 15 mm thick, micro-asperulous or glabrescent, tubercle teeth small, horizontally spreading. *Leaves* scale-like, fugacious or apparently seldom developed, often represented by a transverse ridge or very narrow scar; stipular glands widely separated, very variable, usually small, frequently more or less transverse. *Peduncle* obsolescent, usually represented by a few cusps subtending the pedicels and buds; *pedicel* short, seldom exceeding 10 mm, micro-asperulous or glabrescent; *sepals* glabrous or sparsely micro-asperulous. *Corolla* outside glabrous; inside smooth glossy greenish-purple, strongly reflexed, up to 30 mm diam. when flattened, lobed to $\pm 50\%$; lobes broadly ovate-acuminate, sometimes broader than long, variably micro-sphaerico-papillate, especially towards the apex of the lobes, but smooth to the eye, ciliate with dark purple, vibratile, clavate cilia arising just inside a very narrow subtranslucent plain margin; tube shallowly bowl-shaped, formed by the thickening of the



FIG. 3.
Tromotriche thudichumii from the Tanqua Karoo, showing rhizomatose habit, random inflorescence and flowers with strongly revolute corolla, all typical of the genus.

limb with no evidence of a tube on the outside, markedly pentagonal at the mouth, sometimes shortly pubescent inside. *Corona* raised on a 5-ribbed pedestal, with the widely spreading outer lobes usually above the level of the mouth of the tube; outer lobes dark brown, oblong, lightly channelled, bifid at the apex, up to 2,5 mm long; inner lobes, pale brown, 2-horned with the inner incumbent on the anthers, attenuate or slightly clavate, meeting and crossing at the centre or sometimes shortly ascending, the outer horn linear, horizontally spreading, laterally flattened, usually exceeding the outer lobes. *Pollinia* \pm "D"-shaped, brown, anchor margin yellow, \pm 0,5 \times 0,375 mm. *Follicles* not seen.

This rather rare species with its distribution restricted to the Tanqua Karoo is relatively poorly known compared with its congeners. Its publication as a new species appears to have been long delayed, possibly because of doubts regarding its generic position, since it seems to have been recognised as undescribed as long ago as 1940, when Dr. Villet in ms. proposed the name *Stapelia malherbei*, while an unidentified specimen was collected by Schmidt in 1937. With regard to distribution I cannot do better than quote from Dr. Villet's informative notes attached to coloured sketches in BOL and PRE: "distributed over a wide area, especially in the northern part of the "Ceres Karoo" . . . "always in mesem. bushes, never among rocks".

The stipular glands of this species are quite different from those of *Stapelia* or of its congener *S. engleriana* and are very variable in both shape and colour. Its corona is very distinctive, the inner lobes especially, although quite variable, are always unmistakably "thudichumii". The corolla is also exceptional in that the "tube" is formed entirely from the thickening of the corolla fabric, whereas in the other two species it is clearly evident in the outside shape of the corolla.

MATERIAL EXAMINED

SOUTH AFRICA, CAPE—3219 (Wuppertal): Ratelklip (-BB), drawing only, 24/4/1954, Villet (PRE); Kliprug, between Elandsvlei and Elandsdrift (-BC), 26/11/1942, Wagener in NBG 44548 (NBG); Tulpfontein (-DA), Leach & Bayer 15790 (PRE), idem sub Plowes 4998 (GRA); Near Klein Hanglip (-DD), 30/4/1948, Acocks 14307 (PRE), ibid. cult. PRE, 2/1957, Acocks 18884 (PRE), ibid. Leach & Fyfe 16072 (K); \pm 4 km NW of Beukesfontein (-DD), cult. Umtali, sub Plowes 4701, 26/12/1975, Frandsen s.n. (PRE); \pm 30 mls NE of Karooport (-DD), 19/2/1960, Slade & Rourke in NBG 44529 (NBG). —3220 (Sutherland): Uitkomst (-AA), cult. KGW, 6/1958, Thudichum in BOL 26740 (BOL) in KGW 583/54 (PRE), in NBG 62012 (NBG).

Imprecise or uncertain localities: Between Calvinia & De Bosch, 4/2/1954, Hall in NBG 44579 (NBG); Gansfontein, N of Ceres, cult. Kalk Bay, 1/1940, Malherbe s.n. (BOL); "Calvinia", Schmidt 566 (PRE); Gansfontein, N of Ceres, Villet in NBG 44549 (NBG); "Calvinia Distr.", Hort. Villet., 4/1940, Villet s.n. (BOL); Knersvlakte?, Van Breda 782 (PRE).

Almost certainly erroneous localities: Gobas, S.W.A., cult. Whitehill, 4/1934, *Archer* 760 (BOL); Kapitaïn's Kloof, *Thudichum* in KGW 415 (PRE).

3. *Tromotriche engleriana* (Schlechter) Leach in Jl S. Afr. Bot. **48**: 425 (1982). Type: Described from a live plant and flowers in spirit (B†). Neotype: S. Africa, Cape, near Laingsburg, *Pillans* 60 (BOL!).

The original material is assumed to have been destroyed, *Pillans* 60 is here selected to serve as neotype, the Laingsburg locality was cited by both Berger and N.E. Brown. The flowering specimen selected is supplemented by one in fruit under the same number, which is also in BOL.

Stapelia engleriana Schlechter in Engl. Bot. Jahrb. **38**: 49, fig. 8 (1905).—Berger in Monatsschr. Kakt. **16**: 176 (1906).—N. E. Br. in Thiselton-Dyer, Flora Cap. **4**(1): 979 (1909).—Berger, Stap. u. Klein.: 282 (1910).—Phillips in Flower. Pl. S. Afr. **12**: t. 462 (1932).—White & Sloane, Stapelieae, ed. **2,2**: 640 (1937).—Luckhoff, Stapelieae S. Afr.: 146 (1952).—Jacobsen, Lexicon Succ. Pl.: 376 (1974). Type: as above.

Chromosome number: $2n = 44$, F. Albers, *in litt.*, 1980, K189 (KIEL).



FIG. 4.

Tromotriche engleriana from Bosluiskloof Pass, in cultivation at PRE. A. J. Joubert s.n. (PRE). Photo by courtesy of the Director, Botanical Research Institute, Pretoria.

Plants rhizomatose, with stems arising scatteredly ("50 % growth underground" *Acocks 23636*). *Stems* up to 22 mm thick, sparingly branched, often jointed, lightly sinuate-dentate along the angles, grey-green, pubescent (sometimes glabrous to the eye). *Leaves* fleeting, rudimentary, initially sub-erect soon becoming spreading; stipular glands often obscure, rarely prominent, often absent, easily detached. *Peduncle* pubescent, flowers normally borne singly in close succession, but occasionally two develop together on a "split" peduncle. *Pedicel* and *calyx* densely pubescent; sepals ovate-acuminate, up to 6 mm long. *Buds* often abort after the first flower develops. *Corolla* strongly revolute, with the lobes rolled back so that flowers appear to be circular, ± 20 mm diam., ± 40 mm diam. when flattened; outside pubescent, cream-coloured, flecked and tinged red-brown; inside variably micro-papillate and micro-asperulous, especially around the mouth of the tube, on the lobe apices and the sinus radii; rather finely transversely rugulose with red-brown rugosities on a creamy yellow ground, becoming wholly dark pur-

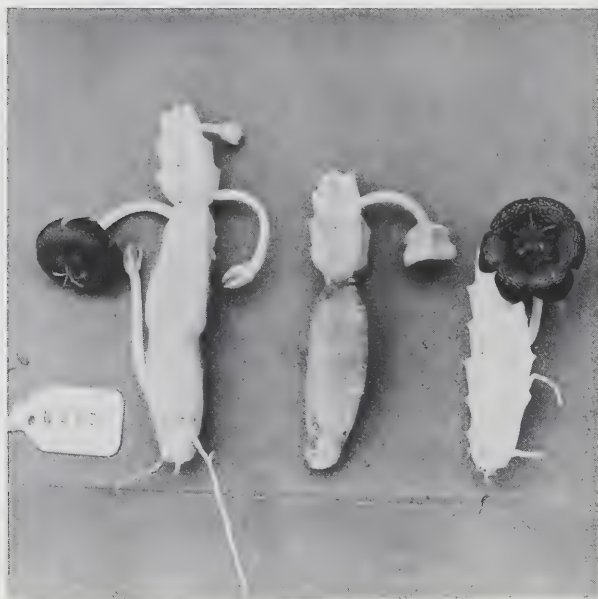


FIG. 5.

Tromotriche engleriana from near Mowers, cultivated at Umtali, showing jointed stems, random inflorescence and typical bud shape.

ple-brown above; mostly eciliate, sometimes with a very short, fine ciliation, rarely with a few short stout simple cilia. *Tube* markedly pentagonal, deeply grooved in the sinuses from the walls being much thickened opposite the lobes, usually pubescent inside. *Corona* shortly raised on a 5-ribbed pedestal, sometimes virtually sessile; outer lobes erectly spreading, obtusely subquadrate, sometimes almost circular, very obtusely bidentate, 3–4 mm long; inner lobes 2-horned, the inner filiform, up to 8 mm long, clavate, tuberculate at the apex, connivent erect, recurved above; the outer spreading, linear, laterally much compressed, often very slightly enlarged and subtuberculate at the apex, up to 5 mm long; anthers much widened at the apex. *Polinia* yellow-orange to red-brown with a yellowish anchor margin, \pm "D"-shaped, $\pm 0,75 \times 0,5$ mm. *Follicles* fusiform, minutely puberulous, up to 100 mm long.

Occurring comparatively frequently in karroid habitats in the area from Worcester and Montagu to as far east as Beaufort West and Willowmore, *T. engleriana* is a remarkably uniform species in both vegetative and floral characters and is perhaps the most easily identifiable of all its tribe, whether as living or dried and pressed material. Its facies is so distinctive that it can usually be unerringly identified even when sterile.

MATERIAL EXAMINED

SOUTH AFRICA, CAPE—3221 (Merweville): 82 km WNW of Beaufort West (-BB), 28/9/1978, *Bruyns* 1750 (NBG); 32 km N of Leeugamka (-BD), 27/11/1978, *Bruyns* 1746 (NBG).

—3222 (Beaufort West): Beaufort West (-BC), cult. PRE 1973, *Grant* (PRE), idem cult. SRGH sub *Leach* 15952 (SRGH); Leeugamka (-BC), 9/1961, *Hardy* 1001 (PRE), idem cult. Umtali, 21/12/1969, sub *Plowes* 3024 (SRGH).

—3319 (Worcester): Mowers (-DA), cult. SRGH, 1978, *Leach & Bayer* 15844 (SRGH); Kenmoor (-DC), cult. KGW, 9/1/1973, *Bayer* 1421 (NBG).

—3320 (Montagu): 12 mls E of Touwsrivier (-AC), 13/6/1965, *Acocks* 23636 (PRE); Avondrust, Touws Riv. (-AC), *Stayner* in KGW 47/71 (NBG); Zout Kloof Farm, 6 mls W of Laingsburg (-BB), hort. Pillans, fl. 30/11/1902, & fr. 12/1903, *Pillans* 60 (BOL, bis); 2 mls SE of Laingsburg (-BB), cult. Cape Town. 11/1904, *Pillans* 679 (BOL, bis); Kareevlakte (-DB), cult. Worcester, 9/1952, *Van Breda* 456 (PRE); ibid., cult. NBG, 26/2/1955, *Hall* in NBG 220/54 (NBG).

—3321 (Ladismith): Dwyka (-BA), cult. Whitehill, 1/1934, *Archer* 697 (BOL); Boschluiskloof Pass (-BC), 10/4/1948, *Acocks* 8620 (PRE); ibid., cult. PRE, 10/2/1982, *Joubert s.n.* (PRE, SRGH); Muiskraal (-CC), cult. KGW 95/61, *Villet* sub *Leach* 15185 (SRGH); Ladismith Karoo, hort. Marloth, 3/1931, *Ferguson* sub *Marloth* 13568 (PRE).

Imprecise or uncertain localities: Rietbron, Willowmore, cult. Umtali, *Pringle* sub *Plowes* 3065 (SRGH); Stinkfontein, Fraserburg Road, cult. Transv. Mus., 2/1936, *Broom* in NH 27637 (NH); Road to Aberdeen, Beaufort West, Willowmore, cult. PRE, 1/1932, *Pole Evans* 11290 (PRE); Cult. Cape Town Municipal Gardens, *Ridley s.n.* (SAM); 5/1928, Beaufort West Div. hort. Bolus, 1931, *H. H. Bolus* 161 (BOL); 5/1928, *De Jager* (BOL); Beaufort West Div., Rhenoster Kop, *Foster* sub *Pillans* 145 (BOL).

SPECIES EXCLUDAE

Tromotriche ciliata (Thunberg) Sweet = *Orbea ciliata* (Thunberg) Leach.

Tromotriche obliqua (Willd.) Sweet = *Orbea variegata* (L.) Haw.

Tromotriche pruinosa (Masson) Haw. = *Caralluma (Quaqua) pruinosa* (Masson) N. E. Br.

Tromotriche mutabilis (Jacq.) Sweet = *Stapelia mutabilis* Jacq., putative hybrid, from seed at Schönbrunn.

Tromotriche mutabilis var. *variabilis* Sweet = putative hybrid, from seed at Schönbrunn.

ACKNOWLEDGMENTS

I am most grateful to the Directors of BOL, NBG, PRE and SRGH [abbreviations according to P. K. Holmgren & W. Keuken, *Regnum Vegetabile* 92 (1974)], for the loan of material and for the facilities of their herbaria when I have been working there from time to time; and to Messrs. M. B. Bayer, Harry Hall and D. C. Plowes for information concerning *Tromotriche*, for material, photographs and other assistance.

A NEW *EUPHORBIA* FROM THE RICHTERSVELD

L. C. LEACH

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ABSTRACT

Euphorbia francescae Leach, a remarkable, new, tuberous rooted species from the Richtersveld, closely related to the little-known *E. quadrata* Nel, is described and its relationships discussed.

UITTREKSEL

'N NUWE *EUPHORBIA* VANAF DIE RICHTERSVELD

Euphorbia francescae Leach, 'n merkwaardige nuwe knolvormiggewortelde species vanaf die Richtersveld, naverwant aan die swak bekende *E. quadrata* Nel, word beskryf en verwantskappe bespreek.

Key words: *Euphorbia*, sp. nov., Euphorbiaceae, Richtersveld.

Euphorbia francescae Leach. sp. nov. propriaque ad *E. quadratam* Nel manifeste artissime affinis sed distinctissima, planta minima, ramis tenuioribus, tuberculatis, brevissimis, floribus masculis longioribus, ovario subglobo-so, stylis brevissimis fere ad basin libris; ad *E. gueinzii* Boiss apparenter etiam affinis sed differt planta bisexuali, involucri bracteis late obovatis truncatis apiculatisque, glandulis tantum 4, capsula usque ad 2-plo grandiore et semine c. 4,5 mm longo foveolato; ad *E. trichadeniam* Pax et *E. pseudo-tuberosam* Pax etiam cognata sed ab illis glandulis quaternis sine processibus longis statim dignoscenda.

Fruticulus nanus tuberifer. *Caulis* tuberans leviter hypogaeus, ramis foliosis apice exorientibus, e basi radicem validam singulam longam emit-tens, hanc ad medium strumosam cum aliquot radicellis, ad tuber amplum profunde subterraneum conjunctam est. *Rami* erecti, simplices vel ramosi, foliorum basiorum reliquiis tuberculati, usque ad 30 mm longi, vetustiores plerumque isdem longitudo rosi. *Folia* caduca, glabra, anguste elliptica, sub-acuta, plicata sed haud carinata, usque ad 20 mm longa, 6 mm lata, subses-siles vel in petiolo brevi, lato, micro-puberulo angustata. *Inflorescentia* terminalis pseudo-umbellata, bracteata; cyathiis bisexualibus, terminalibus, plerumque solitariis, deinceps effectis; bracteae ad folia similes sed bre-

viores proportione latiores. *Pedunculus* minute puberulus, plus minusve, 2,5 mm diam., 5–6 mm longus; involucri bracteae late obovata acuminata saepe subtruncata apiculata. *Involucrum* plus minusve cupiforme, c. 3 mm longum, 4 mm diam. glandulis inclusis, parce minute puberulum; glandulis 4, transverse ellipticis, vix continguis, convexis, viridis, demum aliquam bilabiatas leviter concavis, margine exteriori irregulariter minute crenulato; lobis 5, subquadratis, c. 1,5 mm latis, irregulariter fimbriato-dentatis, ciliatis; floribus masculis 15, pedicellis c. 4 mm longis, breviter pubescentibus; filamentis c. 1,5 mm longis; bracteolis plumosis, c. 3 mm longis. *Flos femi-*



FIG. 1.

A comparison of *Euphorbia francescae* (left) with the type specimen of *E. quadrata* Nel

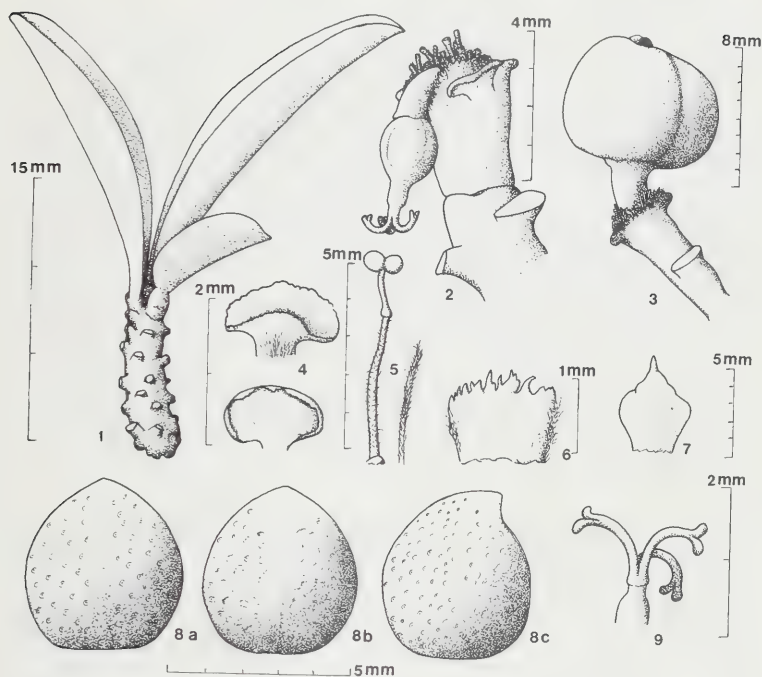


FIG. 2.

Euphorbia francescae

Leach 1. Branch with leaves; 2. Cyathium with exserted ovary; 3. Capsule, adopting a more erect habit shortly before dehiscence; 4. Involucral gland; 5. ♂ flower with bracteole; 6. Involucral lobe; 7. Involucral bract; 8. Seed; 9. Styles. *G. & F. Williamson 3248* (NBG).

neus ex involucri in pedicello crasso, pubescenti, curvatim exsertus; perianthium obtuse 3-lobatum pubescens. *Styli* c. 1,5 mm longi, breviter bifidi, fere ad basin libri, patulo recurvi. *Capsula* glabra, viridis, obtusissime trilobata, plus minusve 10 mm diam., 7 mm alta, ex involucri in pedicello crasso, pubescenti, 3–4 mm suberecte exserta. *Semen* latissime ovoideum subacutum, subrugulosum, foveolatum, pallide roseobrunneum, c. 4,5 mm × 4,5 mm.

Typus: Cape—2817 (Oranjenburg) Richtersveld, Cornellsberg (-CA), *G. & F. Williamson 3248* (NBG).

A tuberiferous dwarf shrublet. *Main stem* tuberous, subspherical, subterranean but only just below ground level, with a number of leafy branches arising from its apex, from the base a long, single, strong root with a few random rootlets and a swollen portion in the middle connects the stem to the deeply buried tuber. *Branches* erect, simple or rebranched, 3–5 mm thick, ± 30 mm long, the old branches browsed down to this length, tuberculate from the remains of old leaf bases, brown and subwoody below, bright shiny red for 1–2 mm at the base of the terminal new growth. *Leaves* arranged in a close spiral, narrowly elliptic, subacute, lightly folded but not keeled, up to 20 mm \times 6 mm, subsessile or narrowing at the base into a short, broad, micro-puberulous petiole. *Inflorescence* a terminal, bracteate pseudo-umbel; bracts similar to the leaves but shorter and proportionally wider, more evidently petiolate and sometimes subtending an axillary bud. *Peduncles* minutely puberulous, ± 2.5 mm diam., 5–6 mm long; involucre bracts broadly obovate, acuminate, often subtruncate apiculate. *Involucre* somewhat tub-shaped, ± 3 mm long, 4 mm diam. including the glands, sparingly minutely puberulous; glands 4, transversely elliptic, convex, green, be-



FIG. 3

Euphorbia francescae, flowering and fruiting branches.

coming 2-lipped, lightly concave, the outer margin irregularly minutely crenulate, very narrowly recurved, not or scarcely contiguous, shortly stipitate with a tuft of hairs at the base of the inner face of the broad stipe; lobes 5, subquadrate, $\pm 1,5$ mm wide, irregularly fimbriate-dentate, ciliate; σ flowers 15, pedicels ± 4 mm long, shortly pubescent, filament $\pm 1,5$ mm long, bract-eoles plumose, ± 3 mm long. *Female flower*, exserted to one side in the gap provided by the absence of a fifth gland; pedicel stout, curved, pubescent; perianth obtusely 3-lobed, pubescent. *Styles* $\pm 1,5$ mm long, free almost to the base, spreading recurved, shortly bifid. *Capsule* glabrous, green, very obtusely 3-lobed, ± 10 mm diam., 7 mm high, exserted 3–4 mm from the involucre on a suberect, stout, pubescent pedicel. *Seed* very broadly ovoid, subacute, subrugulose, shallowly pitted, pale, somewhat pinkish-brown, $\pm 4,5$ mm \times 4,5 mm.

This most distinctive new species is obviously most closely related to *E. quadrata* Nel, which occupies a similar habitat, also in the Stinkfontein-

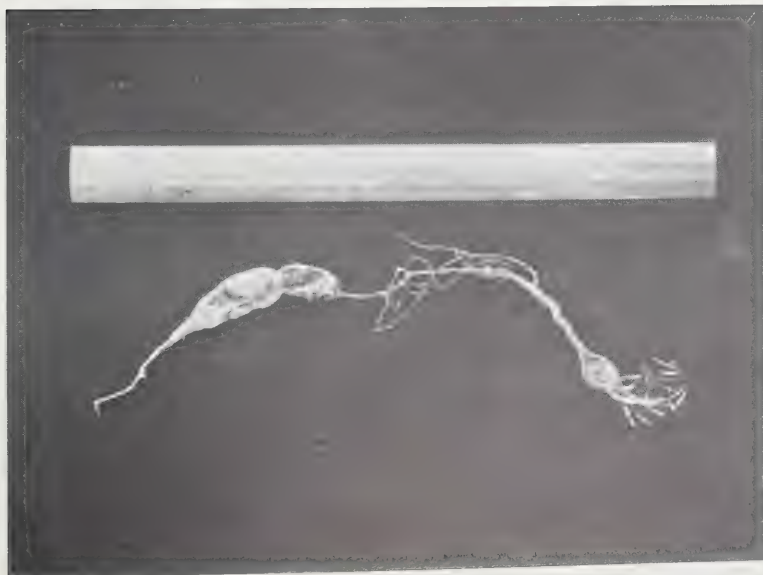


FIG. 4.

The type specimen of *Euphorbia treescae*, G. & F. Williamson 3248 (NBG); with 300 mm scale.

berge, but its much smaller plants differ considerably with very short, tuberculate branches, longer male flowers, a subglobose ovary, and most significantly, in their very much shorter styles which are free almost to the base. There are, apparently, also links with the more widely distributed *E. gueinzii* Boiss., but plants of the new species are bisexual with differently shaped involucre bracts, only 4 glands, a capsule up to twice as large, and a larger pitted seed; there is also a relationship with the widespread *E. trichadenia* Pax and *E. pseudo-tuberosa* Pax, but *E. francescae* may be immediately distinguished from these by its 4 glands which lack the long processes of these species.

Plants were found growing among rocks and bushes at the summit of the Cornellsberg (1 377 m), in the Stinkfonteinberge, in the Richtersveld, by Dr. and Mrs. G. Williamson, specimens being by no means common. An entire plant was extracted from its rocky habitat with considerable difficulty and with a small quantity of flowering and fruiting material gathered from other plants in the vicinity, enabled the foregoing description to be completed.

SPECIMEN EXAMINED

Known only from the type.

It is with great pleasure that this remarkable species is named in honour of Françoise, of this husband and wife team, who in the course of their numerous botanical expeditions and excursions have collected a great deal of interesting euphorbia material for me from many parts of southern and south tropical Africa.

ACKNOWLEDGEMENTS

I wish to thank the Curator, Botanical Research Unit, Stellenbosch, for the loan of the type material of *E. quadrata* Nel.

BOOK REVIEWS

MEDITERRANEAN-TYPE ECOSYSTEMS: THE ROLE OF NUTRIENTS, edited by F. J. Kruger, D. T. Mitchell and J. U. M. Jarvis, with pp. xiii + 552 and 143 figures. Berlin, Heidelberg, New York, Tokyo: Springer-Verlag, 1983. Volume 43 in the series "Ecological Studies". DM 98, approx. US\$ 40.50. ISBN 3-540-12158-7.

This is volume 43 in Springer-Verlag's "Ecological Studies" series and is a companion to *Resource Use by Chaparral and Matorral* (1981), edited by P. C. Miller. The volume consists of 27 chapters, each being either the text of a paper or poster presented at an International Congress on Mediterranean Ecosystems held in Stel-lenbosch in 1980. The text is divided into six sections:

Section I: Evolution and Character of Mediterranean-Type Ecosystems with five chapters,

Section II: Plant Form and Function with four chapters,

Section III: Nutrient Cycling with four chapters,

Section IV: Plant Nutrition with four chapters,

Section V: Community Patterns and Diversity with eight chapters, and

Section VI: Plant-Animal Interactions with two papers. Finally there is an adequate subject index to major topics and each chapter has its own list of references. As such the book generally has a high standard of production and is well bound.

Interest in the ecology of mediterranean-type (MTE's) systems has blossomed in recent years and this book is the sixth that I know of on the subject since 1977. However, this is the first attempt at investigating the rôle of nutrients in determining the structure and functioning of these MTE's. Much controversy still exists in eco-physiological circles of whether water, or nutrients, are most important in determining the structure and function of MTE's. This book goes a long way towards answering this vexed question, which perhaps will never be satisfactorily resolved as both water and nutrients are so intimately linked that their separate rôles may be impossible to totally unravel?

The contents of the volume are reasonably well balanced with attention given to the evolution, function, nutrient cycling and nutrition, patterns of diversity and the rôle of plant-animal interactions in a range of MTE's. As such the book is a necessary addition to libraries, and all students of mediterranean ecosystems and world vegetation. Much of the material is relevant to South African systems, adding a refreshing dimension to available literature on our own ecosystems.

The main disadvantage I see in the volume is that MTE ecologists have again failed to distinguish between what I believe to be two distinct shrubland communities that coincidentally occur in mediterranean climate zones. Both shrublands are essentially evergreen and sclerophyllous, yet one is a heathland and as such not restricted by climate but rather by edaphic factors (Specht, 1979), and the other is the true mediterranean shrubland (di Castri *et al.*, 1981). Until this confusion is resolved the relative rôles of nutrients (and water for that matter) will remain unresolved.

REFERENCES:

- DI CASTRI, F., GOODALL, D. W., and SPECHT, R. L., (eds.), 1981. *Ecosystems of the world. Vol. 11. Mediterranean-type shrublands*. Amsterdam: Elsevier.
- SPECHT, R. L. (ed.), 1979. *Ecosystems of the world. Vol. 9A. Heathlands and related shrublands: descriptive studies*. Amsterdam: Elsevier.

E. J. MOLL

PROGRESS IN BOTANY 44/FORTSCHRITTE DER BOTANIK 44: MORPHOLOGY, PHYSIOLOGY, GENETICS, TAXONOMY, GEOBOTANY, edited by H. Ellenberg, K. Esser, K. Kubitzki, E. Schnepf and H. Ziegler, with pp. xv + 449 and 39 figures. Berlin, Heidelberg, New York, Tokyo: Springer-Verlag, 1982. DM 168, approx. US\$ 67.20. ISBN 3-540-11840-3.

It is a pleasure to be able to review the latest volume of this most excellently produced and valuable series of botanical writings. It comprises 12 sections contributed by an array of distinguished scientists, these sections representing fields as diverse as the stimulating and broad review of general and molecular cytology by A. W. Roberts, of carbohydrate metabolism by E. Beck and H. Hopf, and of the systematics and evolution of the algae by M. Melkonian.

The editors, H. Ellenberg, K. Esser, K. Kubitzki, E. Schnepf and H. Ziegler, are to be congratulated on having maintained a uniformly high standard throughout. The result is a book which is much more than a collection of reviews of literature of the past year. For each of the widely disparate topics included, covering virtually the whole of botanical science, an effective synopsis is given of the current state of knowledge, supported by a bibliography of recent relevant literature. It is noticeable that there has been wide sampling of many of the lesser-known European publications.

A relatively minor criticism which may be levied on a few sections is that the English text deviates from normal English stylistic usage. This is particularly apparent in the section "Vegetation Science". It is too obviously translated.

The small number of diagrams and tables are clear and concise and it is a pity that not more were included.

As we have come to expect from Springer-Verlag, the layout is most attractive. One may, however, regret the absence of an author index.

A. R. A. NOEL

PHOTOMORPHOGENESIS, edited by W. Shropshire Jr., *et al.*, with pp. xxx + 832 and 173 figures. Berlin, Heidelberg, New York, Tokyo: Springer-Verlag, 1983. Volume 16 (parts A and B) in the New Series "Encyclopedia of Plant Physiology (in two parts)". DM 338, approx. US\$ 131.20. ISBN 3-540-12143-9. Not available separately.

Photomorphogenesis encompasses the regulation of plant growth and development by light. The many growth responses which fall under this title are comprehen-

sively covered in the two volumes by contributors who are experts in their fields. The different chapters were written as autonomous units in which the specific field they cover are dealt with comprehensively. This allows the reader to study each chapter as a unit. The editors allowed the contributing authors freedom to express their own views on the topics under discussion. This resulted in chapters which are not only authoritative but in many instances contain useful guidelines for future research. In some instances conflicting views and interpretations were encouraged. This will ensure that young scientists are exposed to divergent hypotheses prior to embarking on research in this fascinating field of plant physiology.

The two volumes cover the whole field of photomorphogenesis comprehensively and contain 29 chapters. It is not necessary to list these. What is significant is that the topic is adequately defined; attention is given to the pigment systems involved, to phytochrome extraction techniques and phytochrome chromophores; the control of plant growth by light with reference to plant hormones and the role of light in seed germination and flowering. In the second volume the attention given to the significance of phytochrome in nature and horticulture and the chapters on marine macroalgae, ferns and fungi are very pleasing. Lastly the important blue-light effects and UV radiation receive adequate mention. One can only conclude that the information contained in the two volumes of *Photomorphogenesis* will long remain an outstanding guide to plant physiologists and that these books are a must for biological workers in this field.

J. VAN STADEN

PEST SLUGS AND SNAILS: BIOLOGY AND CONTROL, by Dora Godon (translated from the German by S. Gruber), with pp. x + 445 and 47 colour photographs, 125 black and white photographs and drawings. Berlin, Heidelberg, New York: Springer-Verlag, 1983. DM 196, approx. US\$ 84.50. ISBN 3-540-11894-2.

This neat and well-produced book reviews the problems caused by gastropods as horticultural and agricultural pests as well as their significance as intermediate hosts for parasites of man and domestic animals. Reference is also made to the role they play as carriers of other diseases which may be transmitted to man or agricultural crops. Mention is also made of the commercial value of some gastropods and information is given on breeding methods.

The first part of the book consists of a thorough though concise treatment of the biology of the gastropods including the physiology, ecology, factors of dispersal as well as a classification and identification key. This part provides a very good background for the inexperienced person who wishes to become acquainted with the gastropods in general and especially with those regarded as pests. It should even be a useful reference work for the more experienced biologist. The illustrations are informative and the colour plates are excellent.

The second part of the book reviews the problems of biological, chemical and non-chemical control and gives an updated account of the available information on this aspect. Although the book was probably primarily aimed at readers in the northern hemisphere, the text fully applies to conditions in southern Africa as most molluscs in this region are immigrants from Europe. As such, I regard this book as essential for those interested in doing research with the aim to curb the problem of molluscs regarded as pests in the agricultural, horticultural and medical fields.

The text is so easy to read that the book should make stimulating reading even for the layman. On the other hand it is so informative that students in zoology or biology would benefit from it. The author has here succeeded in bridging the gap so often found between basic and applied research. The references are extensive and up to date. This is a reference work which should be acquired by all biological reference libraries.

W. F. SIRGEL

XYLEM STRUCTURE AND THE ASCENT OF SAP, by M. H. Zimmermann, with pp. x + 143 and 64 figures. Berlin, Heidelberg, New York, Tokyo. Springer-Verlag, 1983. Springer Series in Wood Science. DM 54, approx. US\$ 22,30. ISBN 3-350-12268-0.

This is a very readable book by Professor M. H. Zimmermann, of Harvard Forestry School, and senior author of the well-known text *Trees: structure & function*, by M. H. Zimmermann & C. L. Brown. Professor Zimmermann, who is a recognised authority in the field of wood structure and tree physiology, gathers in this book the scattered details concerning xylem structure in a very pleasant and personal manner, and marshals them into order. In this process the implications of these anatomical details upon the physiological process of water translocation emerge very lucidly. He rightly stresses the work of the early botanists whose work is frequently overlooked these days. The story of Hermine von Reichenbach's splendid study on tyloses in 1845 is perhaps the best example of this. Modern workers like Bruno Huber, who contributed so much to our knowledge of vascular physiology, are well presented too.

It is the authors aim to present an "ideas" book in the realm of functional xylem anatomy. In this he has succeeded, as he not only presents factual data but speculates about its implications. He is interested in pointing out what we know and what we don't know. The latter is refreshing.

Although this is quite a short book, it contains a great deal of matter. Hence even a brief review of the details of its contents will not be possible. What I would like to do is make some comments that occurred to me, without any value judgements being involved.

Chapter 1. Conducting units: tracheids and vessels

An excellent chapter with clear interpretations and discussions of the anatomical details. Account of the cinematographic analysis techniques to view entire lengths of vessels. Analytical anatomy to determine the number and size of vessels in wood.

Chapter 2. The vessel network in the stem

The most valuable thing for me in this chapter was the excellent interpretation of the vasculature in arborescent monocotyledons, which makes it much easier to understand this apparently complex anatomy.

The dicotyledons and conifers were well dealt with and some very good experiments presented.

Chapter 3. The cohesion theory of sap ascent

Very good chapter on this topic with good experimental data presented.

There is an important point raised on p. 52 showing some of the reasons why Scholander Bombs can give inaccurate readings at certain times.

Chapter 4. The hydraulic architecture of plants

Very useful chapter, with excellent section on plant segmentation, especially in monocotyledons.

Chapter 5. Other functional adaptations

This is a chapter composed of oddments. The section on the aquatic angiosperms and their water flow was the most interesting, giving much to think about.

Chapter 6. Failure and "senescence" of xylem function

Good chapter on embolism formation, tyloses, gum production and heartwood formation.

Chapter 7. Pathology of the xylem

This was the one chapter that did not really turn out properly. The author admits pathology is not his field, but I agree with him that this matter should be included. Some of the matter discussed such as wetwood was very interesting, but the cohesion of the other chapters was lacking.

This book is ideal for senior undergraduate and postgraduate use. As it deals with xylem structure, and general problems it is quite suitable for South African conditions, although most of the plants chosen have come from moist temperate regions.

With 300 references and 64 figures, this book is well illustrated and authoritative. In the references there is a slight lack of consistency, as names with the prefix "von" or "van" may be found under the letter "v" or under the initial letter of the rest of the name.

Finally, the author appeared to be very ill when this book was finished. We hope that his condition was not as serious as he thought and we wish him well.

K. H. SCHÜTTE

PHOTOSYNTHESIS AND PLANT PRODUCTIVITY, edited by H. Metzner, with pp. 340, 142 figures and 60 tables. Stuttgart: Wissenschaftliche Verlags-Gesellschaft mbH, 1983. Paperback DM 32. ISBN 3-8047-0723-8.

This volume contains the reports presented at a joint meeting of the Organization for Economic Cooperation and Development (OECD) and the Studienzentrum Weikersheim, held at Ettlinger Castle from October 11 to 14, 1981. The information contained in the poster sessions has also been included.

In 1981 fifteen countries embarked on a cooperative research project dealing with food production and preservation. The project consists of four subjects, one of which deals with the improvement of photosynthetic efficiency in terms of solar energy used, and the other three with diminishing the waste of energy and agricultural products.

The "photosynthesis efficiency" programme includes 20 research topics grouped into three broad subprogrammes: the study of photosynthesis from the standpoint of the photosynthesising organs, the whole plant and the cultivated field. Although the research was primarily concerned with wheat and maize, some attention was given to other crops such as alfalfa, soybeans, perennial ryegrass, *Euphorbia lathyris*, and others. This book represents a review and evaluation of the results and activities of some 30 laboratories involved in the "photosynthesis efficiency" project.

Following the introduction, three papers deal with the general subject of solar energy conversion and the production of plant biomass. After a discussion by H. Metzner of biological solar energy conversion, J. Fernández, in a paper on photosynthesis and crop productivity, stresses the need of extending areas under cultivation and of finding species with a potential high biomass yield which are adapted to those areas. In the third paper, Klaus Wagener discusses possibilities and constraints in obtaining energy biomass, and points out that although biofuels are at present more costly than comparable fossil fuels, this is expected to change in the foreseeable future.

In the next part, 15 papers summarise the results of *field experiments*. Topics include (among others): production efficiencies of two wheat cultivars during spring growth; leaf characters of wheat in relation to photosynthetic efficiency; protein and chlorophyll content as indicators of senescence in wheat leaves; assessment of maize growth and development in response to irrigation management under subtropical conditions; effects of water stress on photosynthesis and transpiration of *Vitis vinifera*; biomass and protein production of *Portulaca oleracea*; and a preliminary estimate of *Euphorbia lathyris* fuel productivity.

In the section on *studies on whole plants* (16 papers) reports are presented on effects of environmental factors such as temperature, nutrient (N and P) deficiencies, light intensity and water stress on photosynthesis, photorespiration and dark respiration of wheat, maize or soybeans. Some attention was also given to the partitioning of photosynthate in soybeans, a three-compartment model for assimilate transport from maize leaves was proposed, and the effect of cytokinins on pigment accumulation and Hill activity of radish seedlings was studied. In another paper, it is concluded that abscisic acid, depending on its concentration, may influence the transport of sucrose within the plant by affecting sink capacity and/or the unloading of sieve tubes.

Some 21 papers are devoted to studies on plant organs and experiments on the cellular and subcellular level. A wide range of subjects are covered, including: differences in chlorophyll levels, fluorescence, and photosynthetic activity of leaves from high-light and low-light seedlings; effects of benzyladenine on photosynthetic activity of isolated chloroplasts; effects of herbicides such as diuron and bentazon on changes in the thylakoid terpenoid and acyl-lipid composition; ultrastructural effects in chloroplasts, of high and low light intensities, or of NaCl stress, or of different nitrogen sources; and six papers deal with enzyme studies, mainly RuBP-carboxylase, in wheat and maize.

Two papers deal with the mass cultivation of micro-algae. The practicability of using them as a source of protein-rich food is compared to their value as a source of interesting constituents and their possible fermentation to biogas or bioalcohol.

In the final section, seven reports by coordinators on special topics are presented. They are: photosynthesis, respiration and growth (J. P. Gaudillère): water effects on plant growth and development (D. R. Lee); effects of environmental and cultural conditions on the productivity of wheat and maize (T. R. Sinclair); effects of environmental conditions on the mineral demand of plant organs (D. P. Ormrod), or on the general metabolism of sugars, amino acids and organic acids (A. J. Keys), or on photophosphorylation (A. Wild); and enzymic properties of RuBP carboxylase-oxygenase (A. Wild). These are very useful in that they relate the work done in the project to the findings of other researchers in the field. From their comments it is clear that many questions regarding plant productivity in relation to the environment still remain unanswered. Brief reviews on photosynthesis research in the UK and Canada are presented by their national correspondents to OECD.

The book, which is quite modestly priced, is printed by photo-offset on good

quality paper. Line drawings, graphs and tables are on the whole adequate, relevant to the text, and generally clearly reproduced. There are not many photographs; with the exception of a few electron micrographs, they are generally clear. Most of the papers cite the relevant literature but in view of the nature and relative brevity of the communications the discussions are generally also brief. The text is in English, with the exception of three diagrams of experimental lay-outs, where the components have been indicated in French. There is a plant index, but unfortunately no subject index.

The book should be of interest mainly to persons engaged in research on plant productivity, but plant physiologists in general, as well as physiological ecologists, should also find it of interest, particularly the three introductory papers and the coordinators' comments.

J. A. DE BRUYN

BIOLOGY AND ECOLOGY OF MANGROVES, edited by H. J Teas. The Hague: Dr. W. Junk BV Publishers, 1983. Series "Tasks for Vegetation Science" 8. Dfl. 160, approx. US\$ 64. ISBN 90-6193-948-8.

This book represents part of the proceedings of the Second International Symposium on the Biology and Management of Mangroves held at Port Moresby, Papua New Guinea, in July 1980. The book comprises 20 chapters, each of which is based on a paper presented at the Symposium.

The first two chapters, which deal with geology, form a sound introduction. The development of mangroves is considered from a geological perspective and evidence is also presented for the existence of a mangrove community in the Upper Carboniferous period.

The following seven chapters deal with the distribution of mangroves in parts of Australia, New Zealand, Papua New Guinea and China. Unfortunately, some of these areas were treated rather superficially, although the information presented is interesting. Generally, the Australian section was covered well and certainly contributes to a greater understanding of zonation in mangrove swamps.

The list of mangrove fishes of New Guinea is useful and is sufficiently detailed to be able to serve as a basis for comparison with other mangrove areas. The survey of faunal communities of Australian mangroves is fairly general. Regrettably relatively little detailed information is available on faunal organisms, especially microfauna, and very correctly the need for faunal studies is stressed if we are to understand relationships between mangroves and animals, especially in the production of detritus from mangrove sources.

As mangrove detritus has been shown to serve as the energy base for estuarine food webs, an understanding of organic matter breakdown and nutrient cycling is essential. Information on this field is provided by articles on the degradation of mangrove stem and leaf tissues under estuarine conditions and on the occurrence of Phycomycetes which degrade cellulose, chitin and keratin.

Miscellaneous topics include albinism in propagules of *Rhizophora mangle*, translocation studies in cryptoviviparous seedlings, and succession in mangrove communities.

The volume concludes with several chapters on the effect of pollution by sewage and oil spills on mangroves. The stresses imposed on these communities by pollution is clear, although the need for more research in this field is stressed. This section

should have wide appeal in this country where pollution of estuarine waters is common.

This book has a pleasing appearance. The index is comprehensive and the subject matter is laid out clearly. The text is well illustrated with photographs and diagrams which are of a high standard. Each article carries a list of references which will be useful to workers in those fields.

The book should suit many tastes. It will be invaluable to senior students, teachers and research workers in the field of marine botany and estuarine biology in this country.

T. D. STEINKE

ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES: IMPACTS AND MANAGEMENT IN ARID REGIONS, edited by R. H. Webb and H. G. Wilshire, with pp. xxi + 534 and 149 figures. Berlin, Heidelberg, New York: Springer-Verlag, 1983. Springer Series on Environmental Management. DM 132, approx. US\$ 52,40. ISBN 3-540-90737-8.

This volume, one in a series of books concerned with the principles and applications of environmental management, serves to provide a clear understanding of the impacts of off-road vehicles on ecosystems and the implications for ORV management.

The rapid escalation of recreational ORV use during the past fifteen years has aroused controversy in many countries. As more ORVs are used in North America than elsewhere in the world, the management recommendations presented in this book are largely derived from studies made in the Californian deserts. Although specifically related to ORV use in arid regions, the information provided in this authoritative book is generally applicable to use modifications of the physical and biological resources of any lands.

Contributions from a number of authors comprise the twenty-three chapters. These are divided into five main categories: physical effects, biological effects, rehabilitation potential, case histories and management concepts and practices.

The physical effects of ORV use are manifest as compaction and disruption of surface soil, destruction and dispersal of surface stabilisers and accelerated wind and water erosion. The natural stability of soils is thus damaged by vehicle use, and recovery from such disturbance is extremely slow.

The impacts on wildlife are also surveyed; because ORVs generate noise, destroy refuges and cause animal death or injury, the effects are pervasive and long-lasting. Studies on the impacts of vehicles on desert vegetation indicate adverse effects due to the direct destruction of plants and soil compaction. Reduction in plant density, cover and species diversity have been documented, and one study observed that "moderate" ORV use reduced the shrub biomass by 50 % and "heavy use" by 70 %.

An "overview" chapter on plant ecology in deserts provides a thorough assessment of the vulnerability of ecosystems to ORV use. The highly consumptive use of land by recreational ORVs critically stresses many ecosystem components, thereby negating attempts at management within the context of sustained yield.

As the subject of plant succession in arid lands has not been well studied, discussions on this phenomenon are largely theoretical. Emphasis is given therefore, to making a distinction between plant "succession" and simple "re-establishment". The

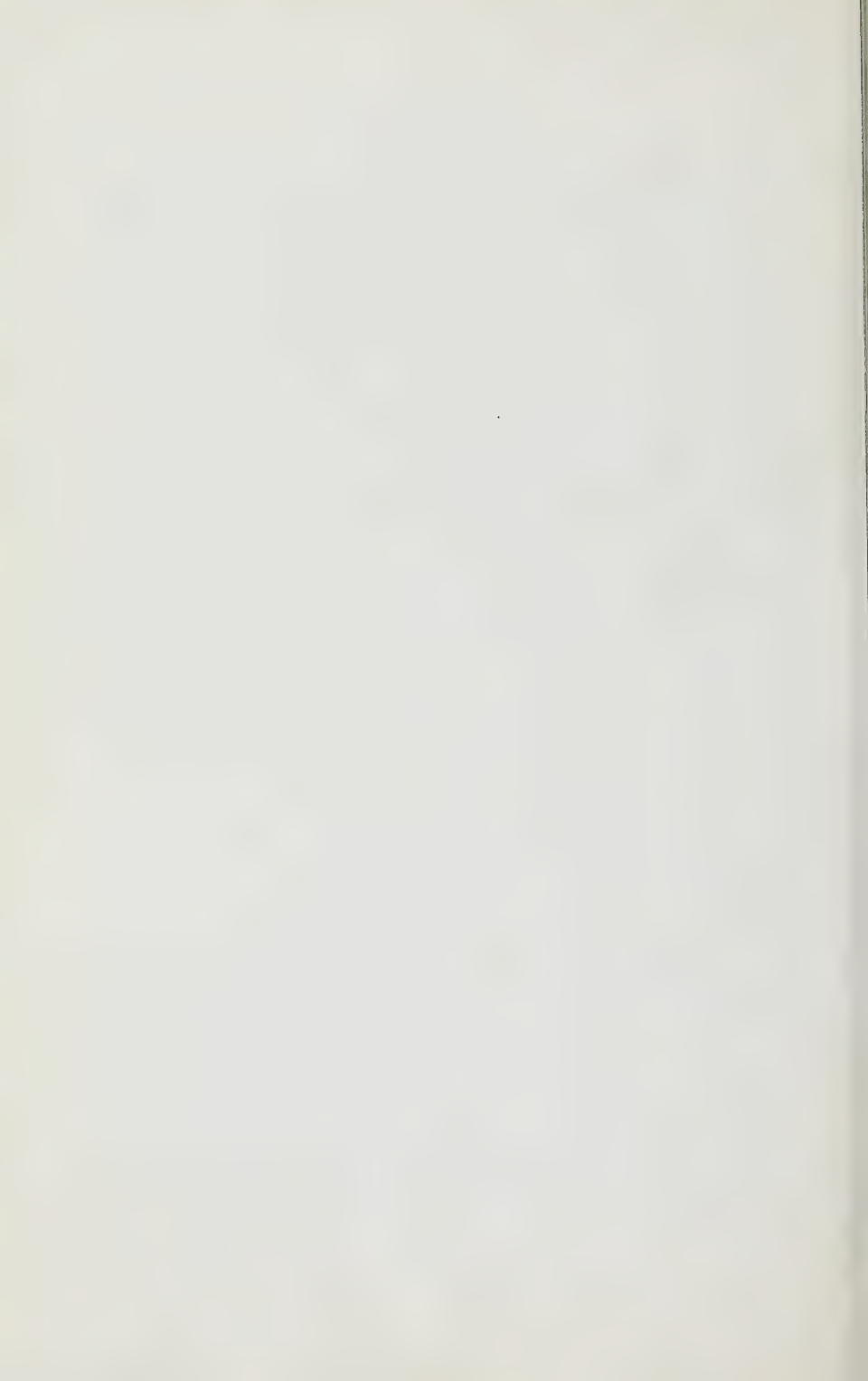
lengthy amount of time required for disturbed areas to recover naturally ("which may take centuries") is obviously an important management consideration and is an aspect which is repeatedly stressed by the various contributors.

Artificial reclamation techniques offer a means (albeit expensive) for rehabilitation of vegetation; results to date however, have been disappointing. It is interesting to note that U.S. state and federal rehabilitation laws place a high priority on indigenous plant species for the revegetation of disturbed lands. Reference is made to all known revegetation studies, and procedures for direct seeding and transplanting of container-grown plants are described; the practical difficulties encountered (as grazing by rabbits) are also outlined. The conclusion is drawn however, that even the best revegetation successes will probably not replace the original ecosystems as measured by number of plants or species diversity.

Three primary aspects of ORV use are recognised for management purposes—pleasure for ORV users, conflict with other users and destruction of resources. Each is examined in detail in the final section of this book. Some of the impacts noted in the previous chapters are restated and summarised "for the convenience of the non-scientist who might skip the more technical chapters". The management concepts, practices, regulations and educational techniques discussed reflect a thorough appreciation of the problems associated with ORV use.

Throughout the book, the text is lucid, accurate and exceptionally well referenced. Case histories, field studies and rehabilitation techniques are well described and illustrated with clear diagrams and black and white photographs which are strikingly explicit. Indeed, the vast amount of information contained in this well-compiled volume will be of immense value to all involved in environmental management, and, hopefully, will instil environmental concern in all ORV users.

E. R. ASHTON



ANNOUNCEMENTS

ICSEB—III

THIRD INTERNATIONAL CONGRESS OF SYSTEMATIC AND EVOLUTIONARY BIOLOGY, 1985

The Congress will be held on 4–10 July 1985 at the University of Sussex, near Brighton, England. It is sponsored by the Royal Society, British Ecological Society, Linnean Society, Palaeontological Association and Systematics Association.

The major aims of this Congress, as with its highly successful predecessors in Boulder, Colorado (1973) and Vancouver (1980), are to encourage and facilitate the integration of the work of biologists in adjacent or over-lapping fields in the general area of systematic and evolutionary biology.

The programme will include a number of symposia devoted to specially-selected broad interdisciplinary themes, with invited speakers. The proposed subjects include:

Symbiosis in Evolution; Conservation of Tropical Ecosystems; Biogeographic Evolution of the Malay Archipelago; Adaptation Aspects of Physiological Processes; Co-evolution in Ecosystems and the Red Queen Hypothesis; Angiosperm Origins and the Biological Consequences; The Measurement of Rates of Evolution; Molecular Biology and Evolutionary Theory; Co-Evolution and Systematics; Molecules vs. Morphology in Phylogeny; Conflict or Compromise? Random and Directed Events in Evolution; Biochemical Innovation in Microbial Communities.

There will also be a full provision for intending participants to suggest and arrange symposia of special interest to particular groupings of biologists. Other sessions will provide opportunities for the presentation of papers concerned with particular topics or groups of organisms. There will also be a number of poster sessions.

Accommodation and meals will be available on the campus of the University of Sussex. In addition, hotels are available in nearby Brighton, an attractive historic resort town on the South Coast.

Further information will only be sent to those who request it. Anyone wishing to be placed on the mailing list, or to suggest topics for Special Interest Symposia, or to contribute to any of the Congress Symposia listed above, should write to:

Professor Barry Cox,
c/o ICSEB Congress Office,
130 Queen's Road,
Brighton, Sussex BN1 3WE, England.

AETFAT—Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale—Association for the Taxonomic Study of the Flora of Tropical Africa. The Eleventh Congress of the Association will be held at the Missouri Botanical Garden, St. Louis, from 11 to 14 June, 1985. The central theme will be Modern Systematic Studies in African Botany. Several special interest symposia are being organized including Systematics and Floristics of African Bryophytes; African Lichens; Biology of Madagascar; African Ethnobotany and Ethnomedicine. Contributed papers on African plant systematics, floristics ecology and related fields will be accepted. For further information write to:

Dr. Peter Goldblatt,
AETFAT General Secretary,
Missouri Botanical Garden,
P.O. Box 299,
St. Louis, Missouri 63166, U.S.A.

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